

RESEARCH DEVELOPMENT AND TECHNOLOGY TRANSFER

ANNUAL REPORT FEDERAL FISCAL YEAR 2023



ALASKA DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES

Photo: Unmanned Aerial Aircraft Collecting Data for Bridge Inspection – Credit: Texas A&M

The Research Development and Technology Transfer (RD&T2) Section, within the Data Modernization and Innovation Office of the Alaska Department of Transportation & Public Facilities (DOT&PF), provides research management, maintains an online library, provides technical assistance, training, and technology implementation services to DOT&PF, local transportation agencies, and their partners.

RD&T2 provides services largely through the collaborative relationships and financial support from the Federal Highway Administration (FHWA). By leveraging resources and developing partnerships with a variety of transportation organizations, professionals and universities, RD&T2 taps into a vast network of expertise and eliminates duplication of effort. RD&T2 also provides an avenue for multidisciplinary support from a network of state agencies.

This is a report of the research, development, and technology transfer activities carried out by the DOT&PF and its partners. **This report covers federal fiscal year 2023, beginning October 1, 2022, and ending September 30, 2023.**

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ACRONYMS

AASHTO: American Association of State Highway and Transportation Officials

AC: Advance Construct (financial)

ADF&G: Alaska Department of Fish and Game

DOT&PF: Alaska Department of Transportation & Public Facilities

DBE: Disadvantaged Business Enterprise

DMIO: Data Modernization and Innovation Office

DOT&PF: Department of Transportation and Public Facilities.

EDC: Every Day Counts

FED: Federal (financial)

FDL: Frozen Debris Lobe

FHWA: Federal Highway Administration

FFY: Federal Fiscal Year

ISER: Institute of Social and Economic Research

LTAP: Local Training & Assistance Program

LWD: Light Weight Deflectometer

MOA: Memoranda of Agreement

NCHRP: National Cooperative Highway Research Program

NC State: North Carolina State University

NHI: National Highway Institute

PBL: Protected Bike Lane

PI: Principal Investigator

RD&T2: Research, Development, and Technology Transfer

SM: State Match (financial)

SP&R-B: State Planning and Research, Part B

STIC: State Transportation Innovation Council

T2: Technology Transfer

TA: Technical Advisor

TSMO: Transportation Systems Management and Operations

TTAP: Tribal Technical Assistance Program

TPF: Transportation Pooled Fund

TRB: Transportation Research Board

UAA: University of Alaska Anchorage

UAF: University of Alaska Fairbanks

UAS: Unmanned Aerial System

US DOT: United States Department of Transportation

UTC: University Transportation Center

FEDERAL FISCAL YEAR 2023 RD&T2 SUMMARY

RD&T2 received funding from the Federal Highway Administration's (FHWA) State Planning and Research Program (SP&R), Local Training & Assistance Program (LTAP), Surface Transportation Program, and state matching funds (SM). Additionally, RD&T2 leverages funding with the Alaska University Transportation Center (UTC), Pacific NW Transportation Consortium, FHWA's State Transportation Innovation Council grant (STIC), FHWA's Technology Transfer training grant, and FHWA's Transportation Pooled Fund Program. There are other individual State

Funding	FFY 2023
Revenues	
SP&R-B Program Funds (80% Fed/20% State Match) (STIP ID#6451)	\$ 11,569,790.00
NHI Training Funds (100% Fed) (STIP ID#6452)	\$ 683,900.00
AASHTO Technical Service Programs (SP&R-B) (STIP ID#25836)	\$ 220,000.00
Local Technical Assistance Program (100% Fed) (FHWA)	\$ 210,000.00
State Transportation Innovation Council- FFY2023 Grant (100% Fed) (FHWA)	\$ 100,000.00
Total	<u>\$ 12,783,690.00</u>
Expenditures & Obligations	
NCHRP Dues (SP&R-B)	\$ 702,889.00
TRB Core Services (SP&R-B)	\$ 141,670.00
AASHTO Technical Service Program (SP&R-B)	\$ 177,000.00
Pooled Fund Studies (SP&R-B)	\$ 289,000.00
NHI/LTAP (obligated)	\$ 1,435,400.00
Research Project Programming (obligated)	\$ 5,232,497.67
Total	<u>\$ 7,978,456.67</u>

Transportation Projects that have some research and/or innovation elements. These projects are not included in the fiscal summary.

Revenues are what was programmed in the 2023 STIP in addition to remaining funds available from previous Federal fiscal years through de-obligations. The expenditures & obligations section reflects actual program costs for FFY23 utilizing all RD&T2 funding available and new eligibilities through the 2021 Bipartisan Infrastructure Law (BIL).

RESEARCH & TRAINING PROJECTS STARTED IN FFY2023

18 NEW TRAINING & RESEARCH PROJECTS IN FFY2023 USING SP&R FUNDS-PART B, LTAP AND STATE MATCH:

Title	FHWA Project # State Project #	Category	Federal \$	State \$	Total \$ Funding
Alaska's Transportation workforce detours: maximizing training opportunities and outcomes in DOT&PF's Key Industries	4000(212) HFHWY00282	Admin	184,184.00	46,046.00	230,230.00
*Low-Emission Ferry Service Analysis	4000(213) HFHWY00281	Innovation	200,090.80	50,022.70	250,113.50
Roadway Foundation Cooling Using Structure Foam Layers	4000(218) HFHWY00294	Materials	120,041.60	30,010.40	150,052.00
Shake Table Tests of Unique High Strength Reinforced Piers	4000(214) HFHWY00296	Bridge	252,983.38	63,245.85	316,229.23
Criteria of Welded Splices on Cold-Bent Reinforcing Steel	4000(216) HFHWY00297	Bridge	153,481.76	38,370.44	191,852.20
Seismic Behavior of Hider Wing-Walls	4000(215) HFHWY00298	Bridge	330,114.40	82,528.60	412,643.00
Alaska Transportation Systems Management & Operations Strategic Plan	4000(217) HFHWY00299	Traffic & Safety	141,477.60	35,369.40	176,847.00
Computer Vision Tools for Bridge Inspections and Reporting	4000(219) HFHWY00301	Bridge	165,057.20	41,264.30	206,321.50
Down-The-Hole Drilling Acoustic Research	4000(220) HFHWY00302	Environmental	122,613.92	30,653.48	153,267.40
Implicit Safety Benefits for Vulnerable Road Users	4000(221) HFHWY00303	Traffic & Safety	158,114.83	39,528.71	197,643.54
Integrated Avalanche Detection Warning & Snow Distribution Mapping	4000(222) HFHWY00304	Innovation	332,000.77	83,000.19	415,000.96
Alaska DOT&PF Title VI and Equity Best Practices	000S(975) HFHWY00305	Admin/Policy	159,398.10	39,849.52	199,247.62
Complete Streets for Alaska DOT&PF	4000(223) HFHWY00306	Traffic & Safety	250,533.25	0	250,533.25
Pilot Protected Bike Lanes- Anchorage	400(225) HFHWY00310	Traffic & Safety	1,178,980.00	0	1,178,980.00

Evaluation of Load Ratings for Alaska Legal Loads Exempted by Federal Law	4000(227) HFHWY00311	Bridge	280,000.00	70,000.00	350,000.00
DOT&PF ArcGIS Image Server Deployment	000S(976) HFHWY00307	Innovation	122,613.92	30,653.48	153,267.40
Remote Sensing for Asset Data Collection in Rural Alaska	4000(224) HFHWY00308	Innovation	339,546.24	84,886.56	424,432.80
STIC FFY23 Freight Route Management Application	4000(226) HFHWY000312	Innovation	100,000	47,372.50	147,372.50
				TOTAL	5,232,497.67

* Advance Constructed ahead of 2023 funding cycle

12 POOLED FUNDED PROJECTS DOT&PF PARTICIPATED IN FFY2023 USING 100% FEDERAL SP&R FUNDS- PART B (NO STATE FUNDS):

Title	FHWA Project #	Category	Current \$ Project Funding (100% federal)
<u>Aurora Program (FY20-FY24)</u>	TPF-5(435)	ITS	25,000
<u>Consequences-Based Analysis of Undrained Shear Behavior of Soils and Liquefaction Hazards, Phase 1: Filling the Data Gaps</u>	TPF-5(485)	Materials	20,000
<u>Connected Vehicle Pooled Fund Study</u>	TPF-5(389)	ITS	25,000
<u>Clear Roads Winter Highway Operations Phase III</u>	TPF-5(479)	Maintenance & Operations	25,000
<u>Transportation Avalanche Research Pool (TARP) 2.0</u>	TPF-5(497)	Maintenance	25,000
<u>Roadside Safety Pooled Fund – Phase 3</u>	TPF5-(501)	Safety	65,000
<u>Develop Countermeasure Strategies for Protecting Bridge Girders Against Overheight Vehicles Impact</u>	TPF-5(484)	Bridge	50,000
<u>Developing and Calibrating Fragmental Rockfall Models using Physics Engines</u>	TPF-5(459)	Geology	30,000
<u>Western Alliance for Quality Transportation Construction (WAQTC) 2021-2025</u>	TPF-5(476)	Materials	12,000
NCHRP Dues – Alaska		National Dues	702,889.00
<u>FY23 TRB Core Program Services for a Highway RD&T Program</u>	TPF-5(511)	National Dues	141,670
<u>2023 through 2025 Biennial Asset Management Conference and Training on Implementation Strategies</u>	TPF-5(492)	Asset Management	12,000
		Total	1,133,559.00

ACTIVE PROJECTS STARTED PRIOR TO FFY2023

8 ACTIVE TRAINING & RESEARCH PROJECTS IN FFY2022 USING SP&R FUNDS-PART B, LTAP AND STATE MATCH:

Title	FHWA Project # State Project #	Category	Federal \$	State \$	Total \$ Project Funding
Impact of Response Spectra Definitions and Direct Displacement-Based Design Simplification for Multi-Span Bridges	4000(208) HFHWY00233	Bridge	211,811.60	52,952.90	264,764.50
Condition Dependent Performance-Based Seismic Design – Phase 1	4000(211) HFHWY00267	Bridge	170,353.92	42,588.48	212,942.40
Rapid Post-Earthquake Displacement-Based Assessment Methodology for Bridges	4000(210) HFHWY00268	Bridge	253,228.80	63,307.20	316,536.00
National Highway Institute CY22-23*	2000(046) HFHWY00271	Training & Tech Transfer		0	683,900.00
Technology Transfer Program FFY22-23* (LTAP)	000S(962) HFHWY00272	Training & Tech Transfer	643,194.06	108,298.51	751,492.57
Cracking Resistance of Alaskan Asphalt with RAP Material	000S(963) HFHWY00273	Materials	156,541.44	39,135.36	195,676.80
Lightweight Deflectometer (LWD) Assessment for Quality Assurance	000S(964) HFHWY00274	Materials	174,958.08	43,739.52	218,697.60
Rectangular Rapid-Flashing Beacons Experimental Feature	000S(965) HFHWY00276	Safety/Experimental Feature	161,145.60	40,286.40	201,432.00

*No-Cost Extension to include 2023 cycle

5 ACTIVE TRAINING & RESEARCH PROJECTS IN FFY2021 USING SP&R FUNDS-PART B, LTAP AND STATE MATCH:

Title	FHWA Project # State Project #	Category	Federal \$	State \$	Total \$ Project Funding
Seismic Behavior of High Strength Reinforcing Steel at Low Temps	4000(205) HFHWY00220	Bridge	294,976	73,744	368,720.00
UAV Bridges and Structures Condition Inspections	4000(206) HFHWY00221	Bridge	149,055.20	37,263.80	186,319.00
Research Administration FFY21-22-23-24*	4000(207) HFHWY00222	Administration	125,700	31,425	157,125.00
Research Deployment FFY21-22-23-24*	000S(945) HFHWY00223	Rapid Research	125,700	31,425	157,125.00
Landslide Collides with Highways: Measuring its Impact to Inform Future Mitigation	4000(139) HFHWY00212	Geotechnical	271,720	67,930	339,650.00

1 ACTIVE PROJECTS STARTED IN FFY2020 USING SP&R FUNDS-PART B AND STATE MATCH:

Title	FHWA Project # State Project #	Category	Federal \$	State \$	Total \$ Project Funding
Urban Workzone User Impacts (AC from FFY21)	000S(948) HFHWY00226	TRAFFIC	100,000	25,000	125,000.00

*Extended existing program to include FFY 23&24 funding.

2 ACTIVE PROJECTS STARTED IN FFY2019 USING SP&R FUNDS-PART B AND STATE MATCH:

Title	FHWA Project # State Project #	Category	Federal \$	State \$	Total \$ Project Funding
RCFST to Cap-Beam GSS Connection	4000(195) HFHWY00152	Bridges and Structures	320,000	80,000	400,000.00
Fish Passage Culvert Slip Linear Research	4000(198) HFHWY00182	Environmental	104,000	26,000	130,000.00

2 ACTIVE PROJECTS STARTED IN FFY2018 USING SP&R PART B FUNDS & STATE MATCH:

Title	FHWA Project # State Project #	Category	Federal \$	State \$	Total \$ Project Funding
Minnesota Drive Ramp Microsurfacing Experimental Feature Monitoring	40000(181) HFHWY00123	Materials	100,000	25,000	125,000.00
Evaluation of Light Pole Foundation Embedment	4000(186) HFHWY00129	Geotechnical & Foundations	200,000	50,000	250,000.00

6 PROJECTS COMPLETED IN FFY2023 –PENDING FINANCIAL CLOSURE

Title	DOT&PF Project #	Federal Project #	Total \$ Project Funding
Evaluation of Liquefaction-Induced Lateral Spread	HFHWY00198	4000(200)	142,690
LED Traffic Signal Luminance	HFHWY00202	4000(203)	254,569
Unmanned Aerial Systems Business Model Assessment for DOT&PF	HFHWY00207	000S(938)	150,000
Optimized Decked Bulb-Tee Girder for Alaska	HFHWY00201	4000(202)	277,080
Left-Side Delineation for Blowing Snow*	HFHWY00227	000S(949)	125,700
Aerial Infrared Scanning of Bridge Decks on Parks Highway to Map Delaminations	HFHWY00270	000S(960)	158,006.40
*= Discontinued			

DESCRIPTIONS FOR NEW PROJECT STARTS AND ACTIVE PROJECTS CONTINUING DURING FFY23

ADMINISTRATION & POLICY

000S945 RESEARCH DEPLOYMENT FFY21-24

Principal Investigator: DOT&PF

Funding: \$317,895

Project Manager: Anna Bosin, P.E.

Estimated Completion: September 2024 (Extended 1 FFY)

This project is established to help DOT&PF research staff identify and facilitate deployment of promising state, national and international research products, services, programs and technologies within the Department. Tasks include necessary efforts such as technology transfer (education), marketing activities to implement completed research projects or products.

Benefits to the State: This funding supports integration of state and national research into DOT&PF business practices.

4000207 RESEARCH ADMINISTRATION FFY21-24

Principal Investigator: DOT&PF

Funding: \$350,049

Project Manager: Anna Bosin, P.E.

Estimated Completion: September 2024 (Extended 1 FFY)

This project provides funding for staff salary and travel expenses to manage the statewide research program. This includes outreach to internal and external stakeholders and provides support for the State Transportation Innovation Committee (STIC), Everyday

Counts Initiatives (EDC), and other innovations. Includes support for DOT&PF research project selection solicitation and approval, and program reporting. Also includes funding for rapid response research opportunities, workforce development and technology transfer.

Benefits to the State: This project enables the department to select the right research projects for the greatest benefit. It also funds other outreach and innovation opportunities.

4000217 ALASKA TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS STRATEGIC PLAN

Principal Investigator: DKS Associates

Funding: \$176,847

Project Manager: Cristina DeMattio

Estimated Completion: December 2024

The purpose of this project is to identify a strategic plan for transportation systems management and operations (TSMO).

Benefits to the State: The desired outcomes of this project include improved transportation performance including travel times and travel time variability, traveler information, event and incident management, situational awareness, and to reduce the number and severity of collisions.

000S975 ALASKA DOT&PF TITLE VI AND EQUITY BEST PRACTICES

Principal Investigator: WSP

Funding: \$199,248

Project Manager: Anna Bosin

Estimated Completion: December 2024



Photo: WSP Instructors with AKDOT&PF Staff Anna Bosin and Rashaud Joseph after the Anchorage Workshop.
Credit: Robespierre Howard

The purpose of this project is to assist and advise DOT&PF's Civil Rights Department with training and guidance regarding Title VI and Equity Best Practices currently used in the industry to ensure there is limited impact to current and potential FHWA and USDOT funding.

Benefits to the State: This project can potentially benefit DOT's workforce development and other applicable civil rights requirements that have change greatly in the past decade. This research will develop customized resources for each region and uniquely designed for the audience types including internal staff, contractors/consultants, and stakeholders.

BRIDGES & STRUCTURES

4000208 IMPACT OF RESPONSE SPECTRA DEFINITIONS AND DIRECT DISPLACEMENT-BASED DESIGN SIMPLIFICATION FOR MULTI-SPAN BRIDGES

Principal Investigator: Dr. Mervyn Kowalsky (NC State)

Funding: \$264,765

Project Manager: Shane Moller

Estimated Completion: June 2025

The objective of this research aims to develop simplifications to the direct displacement-based design approach for multi-span bridges that will facilitate implementation into bridge design practice.

Benefits to the State: Data generated from the computational models will facilitate simplifications to the direct displacement based design approach by reducing the effort to define equivalent viscous damping, target displaced shape, and strength allocation to abutments versus columns.

4000195 REINFORCED CONCRETE FILLED STEEL TUBE TO CAP BEAM GROUTED SHEAR STUD CONNECTION

Principal Investigator: Dr. Mervyn Kowalsky, Giorgio Proestos (NC State)

Funding: \$400,000

Project Manager: Shane Moller

Estimated Completion: December 2024

The purpose of this research is to develop Accelerated Bridge Construction connections for Reinforced Concrete Filled Steel Tube (RCFST) and Reinforced Concrete bridge systems that use “external socket” and “external pocket” connections. This is distinctly different from existing “pocket” and “socket” connections that are internal to the cap and can compromise seismic behavior. Lessons

learned from the development of the steel bridge system (termed the “Grout Shear Stud (GSS) Connection”) will be valuable as the connections described in this proposal are developed.

Benefits to the State:

If results prove to be beneficial, they could be implemented in further design options for GSS connections for RC and RCFST systems. Successful implementation will ideally result in more rapid construction which is an important consideration during Alaska’s short construction season.

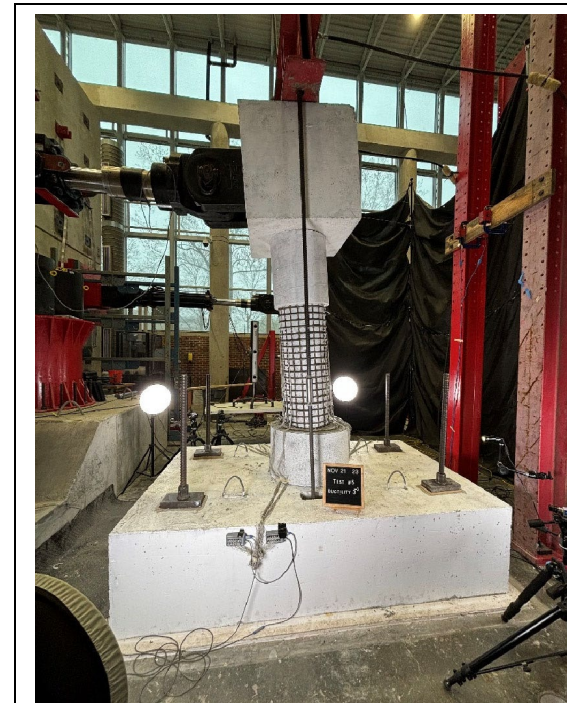


Photo: Lateral displacement during testing of RCFST research project.

Credit: Mervyn Kowalsky, NCSU]

4000205 SEISMIC BEHAVIOR OF HIGH STRENGTH REINFORCING STEEL AT LOW TEMPERATURES

Principal Investigator: Dr. Mervyn Kowalsky, Lina Espinosa, (NC State)

Funding: \$368,720

Project Manager: Shane Moller

Estimated Completion: December 2024

This research is to study the impact of low temperatures on the seismic behavior of columns reinforced with A706 Grade 80 and 100 steel. This will be accomplished through the use of the Buckled Bar Tension test and large scale column tests, both conducted at low temperatures at the NC State Constructed Facilities Laboratory, as well as computational modelling of columns (and bridge systems) using stress-strain models and section hysteretic behavior observed during the conduct of the experiments.

Benefits to the State: Application of high strength steel can potentially reduce the steel content in structures which results in more easily and quickly built structures and can also reduce overall costs.

4000211 CONDITION DEPENDENT PERFORMANCE-BASED SEISMIC DESIGN – PHASE I

Principal Investigator: Dr. Mervyn Kowalsky, Moe Pour-Ghaz, (NC State)

Funding: \$212,942

Project Manager: Shane Moller

Estimated Completion: June 2025

This research project is the start of a multi-phase effort aimed at development of condition dependent performance based seismic design (CD-PBSD). Currently, bridge engineers design a structure assuming that the property of the materials and system remain

unchanged and that its future seismic performance can be adequately predicted using its ‘day one’ properties.

Benefits to the State: This research aims to conduct large-scale tests on bridge columns with corroded reinforcing steel. The resulting tests will provide data for model calibration that can then be used in a future phase to conduct large-scale analysis to assess the impact of structural condition on response.

4000210 RAPID POST-EARTHQUAKE DISPLACEMENT-BASED ASSESSMENT METHODOLOGY FOR BRIDGES

Principal Investigator: Dr. Mervyn Kowalsky, Ashly Cabas, (NC State)

Funding: \$316,536

Project Manager: Shane Moller

Estimated Completion: June 2025

This research project aims to develop a rapid seismic bridge assessment method that can be used for planning, and for post-earthquake assessment (inspection prioritization). Unlike existing methods that can be largely probabilistic, and focus on high-level assessment, the proposed methodology is sufficiently versatile that it can provide a range of information, spanning deterministic bridge specific performance, to probabilistic assessments of bridge vulnerability.

Benefits to the State: This research will produce detailed plans for development of a rapid assessment application that will be developed in a future Phase 2 of the research.

4000214 SHAKE TABLE TESTS OF UNIQUE HIGH STRENGTH REINFORCED PIERS

Principal Investigator: Dr. Mervyn Kowalsky, (NC State)

Funding: \$316,229

Project Manager: Shane Moller

Estimated Completion: July 2026

This project is research to evaluate the dynamic performance of reduced scale Grade 80 reinforced concrete columns, compare performance to that observed during reversed cyclic loading, and develop recommendation for design.

Benefits to the State: The use of high strength steel can reduce congestion of reinforcement into adjoining members. There are also performance advantages and manufacturers are moving towards increasing steel strengths, possibly making it the norm, thus necessitating design recommendations for its deployment.

4000216 CRITERIA OF WELDED SPLICES ON COLD-BENT REINFORCING STEEL

Principal Investigator: Carolyn Fink, (Ohio State University)

Funding: \$191,850

Project Manager: Cristina Demattio

Estimated Completion: December 2024

This project has objectives to determine changes in microstructure and microhardness in the heat-affected zone (HAZ) of welded cold-bent reinforcing steel, to compare the tensile strength and ductility for welds made on cold-bent versus unbent reinforcing steel, determine the monotonic stress-strain behavior locally in the HAZ of welded cold-bent reinforcing steel, and to identify specific requirements and/or acceptance criteria for welding on cold-bent reinforcing steel beyond those in AWS D1.4.

Benefits to the State: The research will result in recommendation for welding on cold-bent reinforcing steel that will ensure mechanical properties of welded splices that are not detrimental to the pile system. Any recommendations will be brought to the AWS Committee for inclusion into the next revision.

4000215 SEISMIC BEHAVIOR OF HIDER WING-WALLS

Principal Investigator: Dr. Mervyn Kowalsky, (NC State)

Funding: \$412,643

Project Manager: Shane Moller

Estimated Completion: July 2026

This project is research to develop tolls to determine the seismic demands experienced by abutment hider walls, develop design details and analysis methods for abutment hider walls that are compatible with the intended performance, and develop recommendations for design.

Benefits to the State: The outcome of the research will provide DOT engineers with the tools to accurately estimate the demand on hider walls, and a suite of options of design details to accomplish different performance objectives.

4000219 COMPUTER VISION TOOLS FOR BRIDGE INSPECTIONS AND REPORTING

Principal Investigator: Dr. Mostafa Tazarv (South Dakota State University)

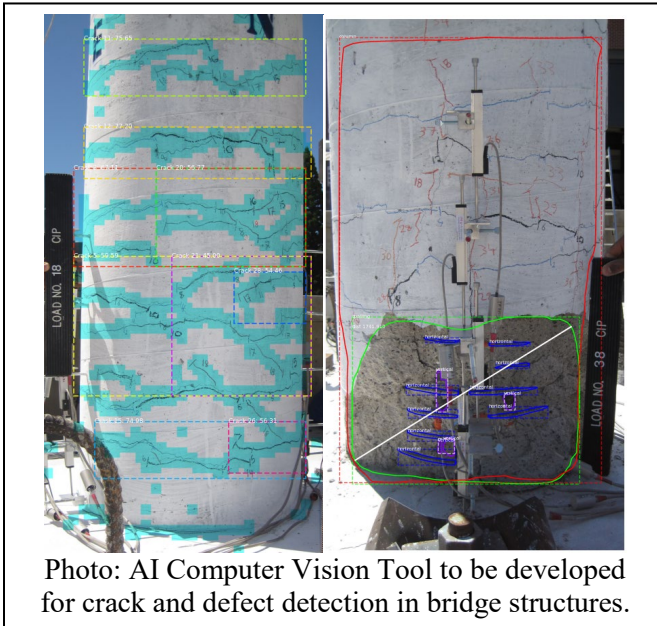
Funding: \$206,321

Project Manager: Shane Moller

Estimated Completion: December 2025

This project focuses on research to develop practical AI tools that help bridge inspectors with defect detection and measurements and to facilitate the inspection and reporting following NBI and MBEI requirements.

Benefits to the State: The research team will produce a final report with recommendations including a set of verified open-source computer vision codes for damage detection and measurements, a user-friendly software for routine inspection and reporting, as well as a user guide and training sessions for DOT&PF engineers.



Alaska Interstate routes which conform to state legal limits but exceed the 80,000-pound Interstate GVW limit b) analysis of vehicles from legal loads up to 125% of state legal loads and c) recommended reduced inspection frequencies according to the new NBIS requirements for any affected bridges.

4000225 EVALUATION OF LOAD RATINGS FOR ALASKA LEGAL LOADS EXEMPTED BY FEDERAL LAW

Principle Investigator: Modjeski and Masters

Funding: \$350,000

Project Manager: Janelle White

Estimated Completion: December 2024

In Alaska, the gross vehicle weight (GVW) is not specified. Alaska DOT&PF is working with Modjeski and Masters to evaluate how this could affect the bridge inventory. The study includes the review of weigh-in-motion (WIM) data, overload permit history, current bridge inventory capacity, plus AASHTO and National Bridge Inspection Standards (NBIS) requirements.

Benefits to the State: The research study deliverables include a) development of a notional load, rating formula, recommended maximum GVW, and live load factors to address loads on designated

ENVIRONMENTAL

4000198 FISH PASSAGE CULVERT SLIP LINER RESEARCH

Principle Investigator: Greg Albrecht. ADF&G

Funding: \$130,000

Project Manager: Shane Moller

Estimated Completion: March 2024

In coordination with DOT&PF, the goal of this research project is to establish criteria for baffle design in liners. The project will integrate engineering topics with fish biology topics with the anticipated end report making recommendations to update the Memorandum of Agreement between DOT&PF and ADF&G regarding fish passage design criteria under roadways.

Benefits to the State:

Results could benefit DOT&PF to optimize these culverts for flow while also doing minimal damage to anadromous fish and improve outcomes for both roadway projects and adjacent natural habitats.



Photo: Tagging and releasing fish at 9-mile Creek in Juneau, AK.

Credit: Greg Albrecht



Photo: Slip lined culvert at 9-mile Creek in Juneau, AK where fish pass trials were conducted.

Credit: Greg Albrecht

4000220 DOWN-THE-HOLE DRILLING ACOUSTIC RESEARCH

Principal Investigator: James Reyff, Illingworth & Rodkin Inc.

Funding: \$153,267

Project Manager: Shane Moller

Estimated Completion: December 2024

The purpose of this project is to conduct research addressing down-the-hole (DTH) drilling noise impacts to marine mammals and produce recommendations on how the data should be used when calculating level A and level B isopleths.

Benefits to the State: This project has the potential to provide information resulting in cost-savings by shortening the permitting and consultation timeframes as well as potentially reducing the level B and level A zones that must be monitored and more often result in shutdown during construction when marine mammals enter the zone.

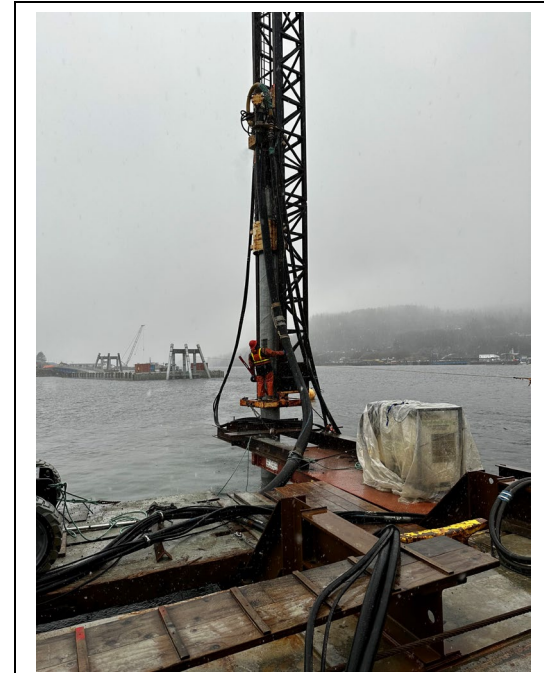


Photo: Drilling piles in the down-the-hole drilling acoustic study.

GEOTECHNICAL

4000186 EVALUATION OF LIGHT POLE FOUNDATION EMBEDMENT

Principal Investigator: Joshua Steelman, University Nebraska Lincoln

Funding: \$250,000

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

Estimated Completion: December 2023

Research the impact of a vehicle on the light pole:

1. Survey how other DOTs handle this issue and provide similar guidance.
2. Provide a literature review of any similar studies that have already been undertaken.
3. Develop an analytical program to address the knowledge gaps and determine the acceptable risk of a base failing from a vehicle impact.
4. Perform crash testing to validate the analytical program for various soil conditions common in Alaska.

Benefits to the State:

Potential reduction in foundation size could result in huge cost savings to the DOT&PF since every light pole foundation developed by DOT&PF engineers or by consultants over the last six years has resulted in large pile foundations in Southeast Alaska.

HFHWY00151 MONITORING AND ANALYSIS OF FROZEN DEBRIS LOBES PHASE II

Principal Investigator: Margaret Darrow (UAF)

Funding: \$339,650

Project Manager: Shane Moller

Estimated Completion: December 2023



Photo: Test site construction at UNL for Light Pole Foundation Embedment project.

Credit: Joshua Steelman, UNL

Frozen debris lobes (FDLs) are landslides in permafrost located along the Dalton Highway corridor. The closest to the highway, FDL-A, has demonstrated a steadily increasing rate of movement which resulted in the realignment of the Dalton Highway in 2016. Based on movement trends, it is anticipated that FDL-A will impact the old embankment by 2021.

The collision of FDL-A with the old embankment represents a unique opportunity to observe a landslide impacting infrastructure in a safe and controlled way and on a predictable schedule.

The objective of this study is to measure the pressure this moving landmass imparts to the embankment, and how the FDL deforms the existing embankment.

Benefits to the State:

The results of this study will help DOT&PF to develop mitigation measures that may slow or stop the movement of landslides in permafrost that threaten critical infrastructure.

MATERIALS & CONSTRUCTION

000S963 CRACKING RESISTANCE OF ALASKAN ASPHALT WITH RAP MATERIAL

Principal Investigator: Billy Connor, (UAF)

Funding: \$195,677

Project Manager: Andrew Pavey

Completed: December 2023

This research project aims to investigate the impact of RAP and rejuvenators on cracking performance of Alaskan HMA materials containing RAP and to develop a method to estimate RAP content for a given mix.

Benefits to the State: Potential cost savings of up to 36% could be achieved when using the correct RAP combinations.

4000181 EXPERIMENTAL FEATURE MINNESOTA DRIVE RAMP MICROSURFACING MONITORING

Principal Investigator: Andrew Pavey, DOT&PF

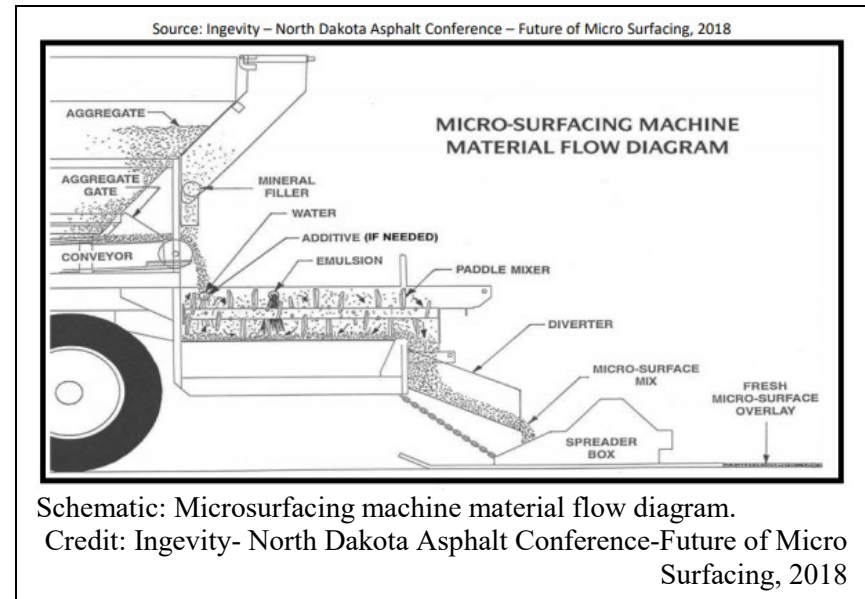
Funding: \$125,000

Project Manager: Andrew Pavey, DOT&PF

Completed: December 2023

During the summer of 2020, DOT&PF Central Region placed a highly modified microsurfacing treatment on Minnesota Drive ramps. This treatment is used by states in the lower 48 as a cost-effective way to extend the life of their roads. A post construction report will be completed by December 2020 after the construction is completed. There were three additional years of monitoring to evaluate the materials performance. This will be the first application of microsurfacing by DOT&PF and will determine if the material can withstand the winter seasons and studded tire use.

Benefits to the State: If successful, this could save the state millions of dollars and improve safety in high pavement rutting locations.



000S964 LIGHTWEIGHT DEFLECTOMETER (LWD) ASSESSMENT FOR QUALITY ASSURANCE

Principal Investigator: Doug Simon, PE HDL Engineering

Funding: \$218,698

Project Manager: Cristina DeMattio, PE

Completed: December 2023

LWD is proposed to replace nuclear gauge compaction testing. Tasks include: 1) Literature Review of current best practices using Lightweight Deflectometers for assurance and acceptance, 2) laboratory and field testing existing DOT&PF Capital Projects in Northern Region and Southcoast Region compared with nuclear testing and results, 3) draft LWD special provisions for DOT&PF quality control and acceptance of soils and aggregates, guidelines for

DOT&PF project testing using LWD, 4) training materials for DOT&PF staff to use LWD

Benefits to the State: Potential cost savings with reduced safety/liability concern for workers who routinely use nuclear gauge testers for compacted subgrade acceptance in construction projects across the state.

4000218 ROADWAY FOUNDATION COOLING USING STRUCTURE FOAM LAYERS

Principal Investigator: Douglas J. Goering

Funding: \$150,052

Project Manager: Cristina DeMattio, P.E.

Estimated Completion: December 2025

This project seeks to evaluate cost-effective solutions to reduce permafrost thaw and resulting embankment deformation. Specifically, evaluating structured foam layers to result in net annual cooling effect and testing designs in a laboratory setting.

Benefits to the State: This project will evaluate solutions optimizing proposed geometries to reduce the height of structured foam layers, thus reducing cost. This study could also lead to design guidelines that DOT or other design engineers could use in design.

SAFETY & TRAFFIC

000S948 URBAN WORK ZONE USER IMPACTS

Principal Investigator: Kinney Engineering LLC

Funding: \$125,000

Project Manager: Cristina DeMattio, PE

Estimated Completion Date: June 2024

Projects in urban settings need an easy to use, repeatable, and unbiased decision-making tool to assist in the evaluation of road closures and lane restrictions to balance impacts to drivers (delay and safety), local access, work zone safety and construction schedules.

Benefits to the State: potential to be applied to make roadway construction and work zones more efficient to safe construction costs and improve network efficiency for the traveling public.

4000221 IMPLICIT SAFETY BENEFITS FOR VULNERABLE ROAD USERS

Principal Investigator: Nathan Belz, University of Alaska Fairbanks

Funding: \$197,644

Project Manager: Mary McRae, P.E.

Estimated Completion: August 2024

This project aims to develop an Implicit Safety Benefit Tool that is easy to use and unbiased to assess safety benefits for vulnerable road users (VRUs) at the Highway Safety Improvement Project (HSIP) project type level.

Benefits to the State: This project provides the State with an opportunity to meet the minimum penalty amount while simultaneously reducing the economic and other costs of vulnerable road user fatalities and serious injuries. The project will develop the safety benefit tool and also develop a workshop and/or training materials for using the tool.

4000223 COMPLETE STREETS FOR ALASKA DOT&PF

Principal Investigator: Smart Growth America

Funding: \$250,533

Project Manager: Anna Bosin, P.E.

Estimated Completion: December 2024

Complete Streets provides safe, accessible, and convenient transportation regardless of mode, supporting active transportation and prioritizing the needs of those who have been historically disadvantaged by the transportation system. It encourages active transportation, community engagement, and social connectivity which can improve physical and mental well-being, grow the economy, and address climate concerns.

Benefits to the State: This project will create policy and procedure framework for DOT&PF to adopt Complete Streets Policy on FHWA funded projects. It includes workshops to review changes in planning, design, environmental, construction and maintenance of complete streets projects.

000S965 RECTANGULAR RAPID-FLASHING BEACONS EXPERIMENTAL FEATURE

Principal Investigator: Vinod Vasudevan, (UAF)

Funding: \$201,432

Project Manager: Anna Bosin, P.E.

Estimated Completion Date: December 2025

This Experimental Features project aims to evaluate the effectiveness of rectangular rapid-flashing beacons (RRFBs) based on field data at the Dowling Road Roundabout Interchange. The effectiveness will be evaluated in terms of both motorist and pedestrian behaviors. Roundabout reconstruction began in Summer 2022 with the RRFBs to be installed Summer 2023. Pre and Post installation observation and data collection will be analyzed such as yield rates, speeds, and pedestrian use of push buttons to activate the RRFBs. Data

collection will be through the CR traffic data collection section, video capture, and field observations. Post construction report and 2 years of monitoring are included in this Experimental Feature Evaluation.

Benefits to the State: RRFBs have the potential to reduce pedestrian crashes up to 47% and increase motorist yielding rates up to 98%.

4000225 PILOT PROTECTED BIKE LANES- ANCHORAGE

Principal Investigator: CRW Engineering Group

Funding: \$1,178,980

Project Manager: Anna Bosin, P.E.

Estimated Completion Date: December 2024

In cooperation with the Municipality of Anchorage, the DOT&PF will be testing a variety of protected bike lane treatments that have proven successful around the country to evaluate their feasibility in Alaska. Phase 1 was temporarily installed along 1 mile of Pine/McCarey in Anchorage during September 2023. A second phase is in design for downtown Anchorage during the summer of 2024 to trial different design elements, materials, and data collection.

A protected bike lane (PBL) is a bike lane with some vertical element physically separating it from vehicle travel lanes, making the bike lane more visible and thereby improving comfort and safety for cyclists. PBLs are designed to improve safety for cyclists of all ages and abilities and have the added benefit of calming traffic and providing an additional buffer to provide a better experience for pedestrians and people with disabilities.

The PBLs will provide valuable information and data to guide future consideration for roadway design projects in Anchorage. The goal of the project is to improve safety, reliability, and equitable access for people of all ages and abilities – including pedestrians, bicyclists, and transit riders.

Benefits to the State: PBLs can improve safety for all users through a corridor, not just bicyclists. The first phase along Pine/McCarrey Street in Fall 2023 showed a 10%-40% improvement in speed limit compliance by drivers as well as had a 10% traffic volume reduction effect. Qualitative and quantitative results will inform follow-on DOT&PF Complete Streets Policy development.



Photo: Pine Street Pilot Protected Bike Lane September 2023. Kids skateboarding using PBL near Polar Bear Park. A bicyclist riding in PBL far side of street.

Credit: Anna Bosin

INNOVATION

4000213 LOW-EMISSIONS FERRY SERVICE ANALYSIS

Principal Investigator: Southeast Conference

Funding: \$250,114

Project Manager: Katherine Keith, Change Management Director

Completed: September 2023

In this research project the Principal Investigator will examine the operational, technical, and financial feasibility, as well as the economic benefits associated with low-emission ferry operations within the Alaska Marine Highway System service area.

Benefits to the State: This project can include economic benefits such as federal financing of new port infrastructure development and new low emission vessels designed for Alaska ports.

4000222 INTEGRATED AVALANCHE DETECTION

WARNING & SNOW DISTRIBUTION MAPPING

Principal Investigator: Pat Dryer, DOT&PF, & Snowbound Solutions LLC

Funding: \$415,001

Project Manager: Pat Dryer, Shane Moller

Estimated Completion Date: September 2025

This project sets out to determine the functionality of an infrasound avalanche detection/warning system for Thane Road to increase the safety of DOT employees as well as the public.

Benefits to the State: This project could improve the safety of snow removal operations following natural avalanches by using infrasound to detect and analyze the size/disruption of avalanches, shorten road closures by improving the efficiency of the detection of avalanche activity, and improve the safety of the roadway for Alaskans to access goods, services, and economic opportunities.

000S976 DOT&PF ARCGIS IMAGE SERVER

DEPLOYMENT

Principal Investigator: Ryan Marlow, DOT&PF

Funding: \$153,267

Project Manager: Shane Moller

Estimated Completion: December 2023

The purpose of this project is to develop the foundation for next steps into the standardization of reality capture and remote sensing data.

Benefits to the State: The image server will allow DOT&PF to collect, manage, and serve imagery from a wide range of sensors on platforms ranging from satellites, aircraft, and drones.

4000224 REMOTE SENSING FOR ASSET DATA

COLLECTION IN RURAL ALASKA

Principal Investigator: Elevate UAS LLC, Kartorium, Ryan Marlow, DOT&PF

Funding: \$424,433

Project Manager: Shane Moller

Estimated Completion: December 2024

The purpose of this project is to address data gaps in rural Alaska by optimizing UAS platforms, identifying which assets can be successfully captured and digitized and by determining acceptable image resolution, data quality standards and file formats. This project combined FFY22 STIC funding with research SP&R-B funding to maximize the project goals.

Benefits to the State: By developing a low cost, repeatable workflow, more regular inspection of rural assets can be conducted. This data will allow DOT to better manage its assets, better allocate funds to keep them in a good state of repair, and avoid costly rehabilitation projects.



Photo: Shane Moller and Pat Dryer setup UAS tools for remote deployment.

Credit: Ryan Marlow

4000226 STIC FREIGHT ROUTE MANAGEMENT APPLICATION

Principal Investigator: Sharan Srinivas, P.E., University of Missouri-Columbia

Funding: \$147,372

Project Manager: Cristina DeMattio, P.E.

Estimated Completion Date: December 2025

Develop and evaluate an intelligent transportation management application for improving the efficiency, safety, reliability, and cost-effectiveness of freight and fuel truck movement to/from the Port of Alaska located in Anchorage, AK. This is a partnership project between the City of Anchorage's Port of Alaska and DOT&PF.

Problem Overview

Alaska's freight and fuel transportation system is unique

- Major exporter of petroleum/coal products, minerals, and seafood
- Dependent on imports for most consumer goods
- Achieved through a statewide multimodal network
- Major seaports and airports serve as entry points

Port of Alaska (PoA)



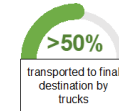
largest port in the state with 125 acres of container yard



4.9M tons of cargo and fuel handled in 2019



\$4.3B statewide commercial activities handled in 2019



Truck transport has substantial impact on the economy and quality of life in Alaska

Graphic: Overview of freight statistics and problem statement in graphical layout.

Credit: MU

Benefits to the State: Truck transportation network located at the port will be able to better route and stage cargo transport within the Port of Alaska footprint. The application could be used outside the port by truck drivers, Alaska 511, and traffic operations centers.

ALASKA TECHNOLOGY TRANSFER

Housed within DOT&PF's RD&T2 Section, the Technology Transfer staff (T2) provide resources and support to federal, state, tribal and local governments and others working in surface transportation in Alaska. We are comprised of two programs, integrated to provide a seamless training and technology transfer service for Alaska's transportation workforce development.

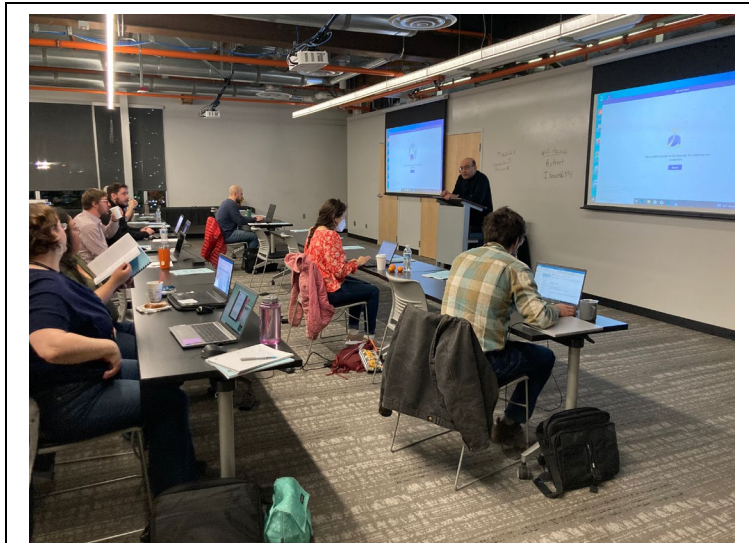


Photo: Steve Saboundjian Instructing Asphalt Constructing and Inspecting Course.

Credit: Cina Fisher

FFY 2023 LTAP & T2 COURSE DASHBOARD

- Total number of classroom training sessions: 90
- Total number of on-line courses completed: 8
- Total number of LTAP student participants: 398
 - Includes Tribal employees
- Total number of FHWA participants: 11
- Total number of DOT employees: 1,646

LOCAL TRAINING AND ASSISTANCE PROGRAM

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.

LTAP's primary focus:

- Training events, outreach among agencies and local governments
- Bring national trainings and technology experts to Alaska
- Coordinating with Alaska's Tribal Technical Assistance Program, managed through UAF's Campus

NATIONAL HIGHWAY INSTITUTE

These SPR-A funds provide transportation-related education programs to AK DOT&PF employees to help improve the quality of the state's highway system through technology transfer to: administration, planning, environmental, ROW, design, construction, and maintenance personnel working for Alaska's transportation infrastructure.

LTAP & T2 HIGHLIGHTS FFY2023

- City of Hughes, AK Community Workforce Development
- Alaska DOT&PF Instructor Led – Contract Admin 643 Pay Items
- FHWA Complete Streets Training
- Critical Thinking for Construction Contract Changes and Claims
- Synchro Studio 11 for Traffic Signal Design
- AGi32 Highway Lighting
- Train-the-trainer for Mobile Elevated Lift platforms and Forklift
- NHI-Urban Drainage Design -NR & SCR
- Asphalt Summit with training

- Tack coats
- Constructing & Inspecting
- In-Place Recycling
- FHWA Resource Center -Progressive Design Build

4000212 WORKFORCE TRAINING: TRANSPORTATION INDUSTRY ASSESSMENT IN AK

Principal Investigator: Dayna DeFeo, ISER

Funding: \$230,230

Project Manager: Anna Bosin, P.E.

Estimated Completion: December 2024

This project is a quantitative analysis of existing training resources statewide that feed the surface transportation industry and continuation rate for students. This project includes interviews, coordination with other agencies and sample workers from the following trades: carpenters, cement mason, electrician, ironworker, operators, pile driver, plumbers and pipefitters, truck drivers/teamsters. Includes reviewing the pathways from underrepresented groups through transportation industry.

Benefits to the State: This project will produce a strategic plan for DOT&PF to optimize existing programs while also addressing gaps/pitfalls in education transition into the trades and recommend areas to focus resources and training opportunities to partner with the surface transportation industry.



Photo: FHWA Progressive Design Build Training.
Credit: Anna Bosin