TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT
for
National Road Research Alliance (NRRA)

Lead Agency: Minnesota Department of Transportation

INSTRUCTIONS:

Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # TPF-5(341) *http://www.pooledfund.org/Details/Study/590*	**Report Period:** Quarter 1 (January 1 - March 31, 2020)	
Project Title: National Road Research Alliance – NRRA http://www.dot.state.mn.us/mnroad/nrra/index.html		
Project Manager(s): Glenn Engstrom (MnDOT) Robert Orthmeyer (FHWA)	**Phone Number:** (651) 366-5531 (708) 283-3533	**E-Mail** glenn.engstrom@state.mn.us Robert.orthmeyer@dot.gov
Lead Agency Project ID: None	**Other Project ID (i.e., contract #):** None	**Project Start Date:** February 22, 2016
Original Project End Date: September 30, 2018 (29 months)	**Current Project End Date:** February 22, 2021 (60 months)	**Number of Extensions:** 1 (Approved - Dec 2017 by NRRA Executive Committee)

Project schedule status → On schedule

Overall Project Statistics:

Total Project Budget	Total Costs obligated to Date for Project	Percentage of Tim and Funding Completed to Date
$4,100,000 (State SPR Funds obligated) Includes 150K - WI partnership funding $4,625,000 After State final payments and Illinois Toll Road Joins NRRA MnDOT also has a separate state partnership fund for groups joining in as associate members – not covered in this pooled fund reporting.	SPR Funding Budgeted $4,640,609 (100.3%) Will make up costs with labor savings from MnDOT as needed in the future Funds Utilized to date $1,616,531 (34%)	Time = 83% (50/60 months)

Project Description:
This pooled fund is open for new states and they can join at any time. This pooled fund will help direct and compliment the use of the MnROAD test track for local, regional and national research, tech transfer and implementation needs. Road owner agencies will provide input and participate in the decision making needed for future MnROAD construction and research scheduled in 2017. MnDOT and Missouri have funded construction in both states. MnDOT funded 2017 construction of test sections at MnROAD to support common goals. Industry and academia will also play an important role to provide critical input on long-term future trends in research and barriers to implementation, including working with their customers and members who play a direct role in implementation.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):
To date ten (10) government agencies and over fifty-five (55+) industry, associations, consultants, and academic institutions have become NRRA members to share their expertise and are learning about new tools and methods to improve and expand upon transportation systems nationally.

- NRRA short and long term research projects are all under contract and work is progressing from 2017 and 2019 along with 5 projects being completed after a call for innovation in 2019, and a 2020 call for innovation went out to the associate membership for future funding in the next quarter of this year.
- All the Long and Short term research projects all have separate online project pages under the teams that are supporting these efforts.
- NRRA members/Teams have met every monthly again this quarter which also acts as TAP meetings for each teams short and long term research efforts.
- Executive Committee meeting October (See team page)
    - Iowa joined (10 government agencies)
    - Budget approved for years 4 and 5
    - Teams Updates / new project ideas
    - Call for Innovation sent out and projects selected. Working on TAP comments and MnDOT contracting.
- Monthly Research pays off webinars have been completed
- 2019 New Projects Ideas developed by the teams using 4-5 dollars
    - 12 new long term research efforts
    - 4 new tech transfer topics
- 2020 TRB session held along with TRB booth to help share NRRA products and stimulate connections within and outside of NRRA.
- Budget sheet is attached at the end of this report.
- See the NRRA website for details on all the teams' activities.

Anticipated work next quarter:
The following is expected to be completed for next quarter.

- Continue to update MnROAD database with data from spring 2020 including performance & material testing data along with supplying the data to the researchers on contract with NRRA.
- See listing of contracts in attachment C
- 2017 - 8 Long Term Research Contracts efforts will continue with the technical advisory panels (TAP) leading the technical direction – team pages will be updated to show the progress.
- 2017 - 6 Technical teams will meet once every month that will also include TAP meetings for each short and long term project expected. New team added and being developed.
- 2019 New Projects Ideas to be developed into contracts and are being worked on
    - 12 new long term research efforts (12 contracts)
    - 4 new tech transfer topics (one contract)
- NRRA Research Pays-Off and Newsletters will be done each 3rd week of each month.
- May NRRA Workshop is being worked on by the pooled fund team and will be ready by TRB – expect this to have to be held online.
- TRB session and booth have been planned again for January 2021.

Significant Results:
Currently this pooled fund is working well for all the members. We have shared resources and technology with each other related to intelligent construction and have discuss a number to topics in the technical teams. More formal documentation will start to be developed at the contracts are awarded and this work begins.

NRRA is up to 10 government members and at 55+ associate members. NRRA Agencies and Associates members make up the now 6 teams that play an important technical role in setting both the technology transfer and long term research needs. Each team has been active this summer meeting every two weeks to develop and prioritize ideas that fall into each of these categories above to meet both local, state, regional and national research needs. The teams report directly to the NRRA executive committee.

The initial push by each of the NRRA technical teams is to develop long term research needs and the MnROAD test sections that will be used to support these initiatives. MnDOT is providing $3.1 million of construction funding to support NRRA long term research needs to be built at MnROAD in the summer of 2017. Each team is working to get the final designs and special provisions to MnDOT so the plans can be developed and a formal construction project can be let in March 2017. Long term research includes researching HMA overlays of PCC, enhancing HMA compaction, fiber reinforced concrete, effects of diamond grinding on questionable aggregates, PCC early opening to strength, optimizing PCC cement content, compacted concrete pavements for city streets, cold central plant recycling, recycled aggregate bases, large stone subbases, maintaining HMA and PCC roadways, and PCC partial depth repair. Each topic/test section will provide a resource for future research contracts that are under development by teach team.

Other important team activities include the formation of technology transfer topics. The NRRA technology transfer team has been approved by the executive committee to fund 2 technology transfer topics from each of the four technical teams. Each topics goal is to pull together the existing state and national state of practice so that a common practice or specification can be developed by the members. Prioritized topics include longitudinal joint construction performance, tack coats, design and performance of concrete unbonded overlays, repair of concrete joint related distress, large unbound subbase materials, subgrade design, surface characteristics of diamond ground PCC, and pavement preservation approaches to lightly surfaced roadways. Currently the teams are updating the problem statements so that a MnDOT hired contractor can be hired to complete the work.

More information on these efforts including the long term research and technology transfer topics can be found under each of the team member's webpage. Summary of the projects are also attached in attachment C at the end of this report.

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems)

None

Potential Implementation:
See the NRRA team pages for implementation topics that are being developed – TAP members of each of the contracts and teams will be asked to help the development of implementation for the technology transfer team to push with its members. This is a focus area that is probably the hardest part of successful research. The technology transfer team will be focused on this topic in the upcoming months.

Attachment A - NRRA Budget Summary (January 2020) TPF-5(341) National Road Research Alliance - NRRA Pooled fund

Associate portion see 2017-010 - TPF-5(341)

Current		2016	2017	2018	2019	2020	Total
CA	Obligation	-	150,000	50,000	150,000	150,000	500,000
	Payment	-	150,000	50,000	150,000	150,000	500,000
IA	Obligation					150,000	150,000
	Payment					150,000	150,000
IL	Obligation	150,000	150,000	150,000	150,000	-	600,000
	Payment	150,000	150,000	150,000	150,000	-	600,000
MI	Obligation	150,000	150,000	150,000	-	-	450,000
	Payment	150,000	150,000	150,000	-	-	450,000
MN	Obligation	150,000	150,000	150,000	150,000	150,000	750,000
	Payment	150,000	150,000	150,000	150,000	150,000	750,000
MO	Obligation	150,000	150,000	150,000	150,000	150,000	750,000
	Payment	150,000	150,000	150,000	150,000	150,000	750,000
ND	Obligation	-	-	-	75,000	75,000	150,000
	Payment	-	-	-	75,000	75,000	150,000
WI	Obligation	150,000	150,000	150,000	150,000	150,000	750,000
	Payment	150,000	150,000	150,000	150,000	150,000	750,000
Totals	Obligation	750,000	900,000	800,000	825,000	825,000	4,100,000
	Payment	750,000	900,000	800,000	825,000	825,000	4,100,000

Expected		2016	2017	2018	2019	2020	Total
CA	Obligation	-	150,000	50,000	150,000	150,000	500,000
	Payment	-	150,000	50,000	150,000	150,000	500,000
IA	Obligation					150,000	150,000
	Payment					150,000	150,000
IL	Obligation	150,000	150,000	150,000	150,000	150,000	750,000
	Payment	150,000	150,000	150,000	150,000	150,000	750,000
MI	Obligation	150,000	150,000	150,000	150,000	150,000	750,000
	Payment	150,000	150,000	150,000	150,000	150,000	750,000
MN	Obligation	150,000	150,000	150,000	150,000	150,000	750,000
	Payment	150,000	150,000	150,000	150,000	150,000	750,000
MO	Obligation	150,000	150,000	150,000	150,000	150,000	750,000
	Payment	150,000	150,000	150,000	150,000	150,000	750,000
ND	Obligation	-	-	-	75,000	75,000	150,000
	Payment	-	-	-	75,000	75,000	150,000
WI	Obligation	150,000	150,000	150,000	150,000	150,000	750,000
	Payment	150,000	150,000	150,000	150,000	150,000	750,000
Illinois Tollway	Obligation					75,000	75,000
	Payment					75,000	75,000
Totals	Obligation	750,000	900,000	800,000	975,000	1,200,000	4,625,000
	Payment	750,000	900,000	800,000	975,000	1,200,000	4,625,000

Funding Summary - April 23, 2020

Current Obligation	4,100,000	Missing IL, MI 2019 and MI 2020 payments - expect
Funding Expected	4,625,000	After above payments are made - budget number

Attachment B - NRRA Budget Summary (April 23, 2020)

Note after some line items are adjusted for funding that was not used NRRA income will match the funding used for labor and contracting. This spreadsheet is approximate summary of income and spending – MnDOT is tracking the exact dollars in their financial system.

For 2020 - quarter 1 report **updated 4/23/2020**

Funding Group	Description	Total Funding (A)	Approved Contract Funding (B)	Percent Contracted (B/A)	Avalible for new projects (A-B)	Paid Invoices (D)	Percent Invoiced (D/B)	Comment
States (SPR)	SPR - Pooled Funds (9 agencies) - Pooled Fund + Future	$ 4,475,000	$ 4,741,698			$ 1,616,531	34.1%	
Partnership (Wisconsin)	Wisconsin Partnership (State Funding used instead of SPR)	$ 150,000	$ 150,000			$ 0	0%	PCC Early Opening - Pitt
	SPR Totals=	**$ 4,625,000**	**$ 4,891,698**	106%	$ (266,698)	$ 1,616,531	33%	
	if budget adjusted for money not expected to be used		**$ 4,640,609**	100.34%	$ (15,609)	does not account for MnDOT Labor changes		
Parnerships	Construction Partnership Donations (not income for NRRA)	$ 3,298,621						MnDOT and MODOT
		$ 7,923,621	* NRRA Associate funding not included in this budget					

NRRA Focus Areas	Effort Type	Item (Letter.#)	Project Charge	General Outcome / Deliverable	Vendors	Funding Budget	SPR Pooled Funding			Partnerships		Agency Self Funds	
							Budget	Spent	Percent	Budget	Spent	Spent	Who
Marketing	Labor	M1.1	TPF15341A	MNDOT Labor - (Website, Monthly Newsletter, Written Documents/Marketing)	MnDOT	125,000	125,000	125,000	100%				
				Costs will be accounted in TPF15341D - not in summary at the bottom of sheet		MnDOT TPF15341D will cover (Adjust)							
Tech Transfer (T)	Purchase	T1.1	TPF15341	Agency travel / meals / meeting room costs	MNDOT PO	115,000	115,000	33,108	29%				
	Contract	T1.2		Communication (Written, Newsletter, video, Website)	TBD	40,000	40,000	0	0%				
	Contract	T1.3.1	TPF15341	Tack Coats Longitudinal Joint Construction Performance Design and Performance of Concrete Unbonded Overlays Repair of Joint Associated Distress Pavements Larger Subbase Materials - Done by Iowa State Subgrade Design for New and Reconstructed Surface Characteristics of Diamond Ground PCC Surfaces Pavement preservation approaches for lightly surfaced roadways Partial Depth Repairs of Concrete E-Ticketing	2016 State of Practice (SRF)	95,626	95,626	80,914	85%	These are the top two topics from each team established in 2016			
	Labor	T1.3.2	TPF15341B	Tech transfer write-ups (MnDOT Labor) - Topics Below	MnDOT	20,000	20,000	15,040.16	75%				
	Contract	T1.5.1	TPF15341	HMA – Asphalt Mixture Rejuvenator Synthesis PM - NRRA Spray on Rejuvenator Synthesis PM - Concrete Pavement Restoration (CPR) for Bonded Concrete Overlays of Asphalt (BCOA) PM - Service Life Enhancement of Substrates Overlaid with Thin Overlays (UTWBC, Chip Seals & Microsurfacing) for each state	2019 State of Practice (WSB)	92,302	92,302	43,088	47%	These are the top two topics from each team established in 2019			
Research (R)	Purchase	R1.1	TPF15341	2017 MnROAD Constrruction Sensor Purchases	MnDOT PO	184,672	159,130	184,672	100%				
				2018 CCP Missouri Sensor Purchases - broken off the 60K avalible			25,542						
	Labor	R1.3	TPF15341C	Inspection (MnDOT) - MnDOT approved operating funds for any additonal costs over the initial budget - MnDOT fund from Dec 17 budget report	MnDOT	50,400	50,400	50,400	100%				
				Costs will be accounted in TPF15341D - not in summary at the bottom of sheet		MnDOT TPF15341D will cover (Adjust)							
	MnROAD Labor	R1.4	TPF15341D	MnROAD Staff - Construction, Sensors and Performance Monitoring MnDOT approved operating funds for any additonal costs - 120K approved by EC - MnDOT fund from Dec 17 budget report	MnDOT	825,318	279,318	530,362	72%			40,940	MnDOT
		R2.4		Approved $120K extra funding for monitoring 2018			120,000						
		R3.4		Approved $200K extra funding for monitoring 2019			200,000						
		R4.4		Approved $200K extra funding for monitoring 2020			200,000						
		R1.8		Missouri Sensor Labor Costs for 2018 installs - CCP - broken off the 60K avalible			26,000						
				Accounting line item - cover overcharges to A and C (shows as double because of neg ballances above) - MnDOT funding for operations of NRRA			Adjust Cost	63,512					
	Contract	R1.5	TPF15341	PCC Sampling/Testing	AET Consultant	61,514	20,000	61,514	100%				
		R2.5		Additional Funding Approved (low initial estimate)			41,514						
	Contract	R1.6		HMA Performance Testing (75K original Estimate)	TBD	75,000	75,000	0	0%				
	Contract	R1.7		Partial Depth Repairs Construction (not in construction contract)	Diamond Surfacing	78,662	40,000	78,662	100%				
		R2.7		Additional Funding Approved			38,662						
	MnDOT Agreement	R1.8		Compacted Concrete Pavement Construction (not in construction) - $50K original	Missouri DOT								
				Missouri CCP Construction, Testing, Monitoring Contract (Missouri Hired)	Hired University	125,000			NA			125,000	MoDOT
	Contract	R1.9		Diamond Grinding Construction (not in construction contract) - $50K	**Not Done**								
	2017 Long Term Projects	R1.10	TPF15341	HMA Overlay and Rehab of Concrete and Methods of Enhancing Compaction	UNH	169,970	169,970	64,632	38%				
		R1.11		Cold Central Plant Recycling	AET Consultant	99,997	99,997	49,015	49%				
		R1.12		Fiber Reinforced Concrete Pavements	UMD	149,999	149,999	34,048	23%				
		R1.13		Long Term Effects of Diamond Grinding - $75k	**Not Done**								
		R1.14		Conctete Early Opening Strength to Traffic	UofPitt	149,999			NA	149,999	0		
		R1.15		Optimizing the Concrete Mix Components for Contractors	Iowa State	147,627	147,627	23,096	16%				
		R1.16		Compacted Concrete Pavements for Local Streets - $80K - Did do in Missouri	**Not Done**								
		R1.17		Recycled Aggregates in Aggregate Base and Larger Subbase Materials	Iowa State	225,000	225,000	30,370	13%				
		R1.18		Maintaining Poor Pavements	SRF	77,963	77,963	28,725	37%				
		R1.19		Partial Depth Repair	Braun Inertec	72,295	72,295	30,826	43%				
	2019 Long Term Research	R1.21	TPF15341	HMA – Asphalt Mix Rejuvenator Test Sections (added 50K in April 2020)	University of New Hampshire	150,000	150,000		0%				
		R1.22		PM - Spray on Rejuvenator Test Sections (added 50K in Aprl 2020)	RFP coming out	150,000	150,000		0%				
		R1.23		ICT - Levels 3-4 Intelligent Compaction Measurement Values (ICMV) for Soils Subgrade/Aggregate Subbase Compaction	Transtec Group	162,024	162,024		0%				
		R1.24		ICT - Support Importing, Viewing and Analysis of Dielectric Constant Data in Veta	Transtec Group	45,000	45,000		0%				
		R1.25		ICT - HD and VHD Seismic Approaches for Roadway Evaluation	Park Consulting	299,886	299,886	52,972	18%				
		R1.26		Geo - Mechanistic Load Restriction Decision Platform for Pavement Systems Prone to Moisture Variations	University of New Hampshire	90,231	90,231	15,528	17%				
		R1.27		Geo - Environmental Impacts on the Performance of Pavement Foundation Layers	Michigan State	35,000	35,000	3,000	9%				
		R1.28		Geo - Permeability of Base Aggregate and Sand		30,000	30,000		0%				
		R1.29		Geo - Improve material inputs into mechanistic design properties for reclaimed HMA Roadways		30,000	30,000	3,000	10%				
		R1.30		PCC - Construction Report for Jointless FRC Roundabout in Minnesota	Iowa State	49,999	49,999	15,046	30%				
		R1.31		PCC - Incorporate Joint Faulting Model Into BCOA-ME	Contracting Uof Pittsburg	25,000	25,000		0%				
		R1.32		PCC - Engineered Dowel and Tie Bars combined with LTPP SPS-2 Determination of Causes for Cracking Over Dowel Bars	ERES Consulting	101,083	101,083		0%				
	2019 Call for Innovation	R1.33	TPF15341	Blending of Higher Strength Aggregates with Recycled Concrete and Marginal Aggregates to Improve Concrete Properties	Contracting - UofSt Thomas	32,332	32,332		0%				
		R1.34		Performance of Concrete Overlays over Full Depth Reclamation (FDR)	Contracting - ARM	34,265	34,265		0%				
		R1.35		Bio-material Maintenance Treatments	Contracting - Iowa State	50,000	50,000		0%				
		R1.36		Innovative Practical Approach To Assessing Bitumen Compatibility As A Means Of Material Specification	Contracting - Cargill	204,119	204,119		0%				
		R1.37		Cold Asphalt Recycling Technologies using Rejuvenating Asphalt Emulsion: Impact; Implementation; Specification	Contracting - UNH	141,442	141,442		0%				
	Contract	R1.38		Support Contract for T1.3.1 (SRF) Repair of Joint Associated Distress Pavements	Contracting - Iowa State	5,000	4,972		0%				
	2020 Call for Innovation	R1.39		Call for Innovation - Project 1	Summer 2020	100,000	100,000		0%				
		R1.40		Call for Innovation - Project 2	Summer 2020	100,000	100,000		0%				
		R1.41		Call for Innovation - Project 3	Summer 2020	100,000	100,000		0%				
		R1.42		Call for Innovation - Project 4	Summer 2020	100,000	100,000		0%				
Construction	MnDOT	M1.2	MnDOT	2017 MnDOT Funding of **~36 - 500' equivalent test cells**	C.S. McCrossan	3,132,681						3,132,681	MnDOT
	MODOT	M1.3	MODOT	2018 Missouri CCP Construction Costs	Missour Best	150,000						150,000	MoDOT
					Totals =	**8,299,406**	**4,741,698**	**1,616,531**	**34.1%**	**149,999**	**0**	**3,298,621**	
							(B)	(D)	(D)/(B)	Research Partnerships		Agency Partnerships	

Attachment C – NRRA Project Listing

NRRA Geotechnical Team

Contract Duration — Initial / Extension

Large-Aggregate Granular Materials (3-6+ inch) Used as Bases or Sub-bases

Michigan State University Bora Cetin	100% Complete	2017	2018	2019	2020	2021	2022

Technology Transfer - The project involves sharing existing uses/applications, research, and structural pavement design concerning the use of these larger granular materials. Products include design guidance for the use of this material, recommendations on how to incorporate this material into pavement designs, and typical construction special provisions.

Subgrade Design for New and Reconstructed

SRF Consulting Joe Korzilius	5% Complete	2017	2018	2019	2020	2021	2022

Technology Transfer - Currently on hold for better definition from TAP on this project. Evaluate factors related to design, construction, and performance related to depth of sub cuts, quality of backfill material, applications for subgrade preparation, and the use of geosynthetics for both concrete and HMA. Design guidelines for a cost effective approach to design subgrades.

Improve Material Inputs into Mechanistic Design Properties for Reclaimed HMA & Recycled Concrete Aggregate (RCA) Roadways

Michigan State University Bora Cetin	5% Complete	2017	2018	2019	2020	2021	2022

Review of RAP and RCA material characteristics using resilient modulus (Mr), CBR/UCS, gradations along with construction specifications. Developing a more consistent material input and specifications between agencies. The outcome of this research is a pavement design specification for RAP and RCA.

Environmental Impacts on the Performance of Pavement Foundation Layers - Phase I

Michigan State University Bora Cetin	5% Complete	2017	2018	2019	2020	2021	2022

This project has two main goals: (1) develop a model to predict the maximum/minimum frozen soil depths, freezing and thawing duration via use of standard climate data that includes precipitation, shortwave radiation, and air temperature and (2) develop a model to predict the performance of pavements that are subjected to severe freeze-thaw cycles.

NRRA Geotechnical Team

Contract Duration — Initial / Extension

Determining Pavement Design Criteria for Recycled Aggregate Base and Large Stone

Michigan State University
Bora Cetin

80% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

The goals of the project is to determine the field and laboratory performance of materials and test sections built with recycled aggregate bases (RAB) including recycled concrete aggregate (RCA), recycled asphalt pavement (RAP), develop a method to estimate the stiffness and permeability of RAB and LSSB designs, prepare a pavement design and specifications.

Permeability of Base Aggregate and Sand

University of Wisconsin
William Likos

10% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

The objective of this project is to quantitatively assess permeability of base types for design. Laboratory permeability on aggregates of different types, gradations, angularity, fine contents, and crushing percentages. A simple predictive tool that may be used to assess permeability from gradation, crushing percentage, fines content, aggregate angularity, and material type.

Mechanistic Load Restriction Decision Platform for Pavement Systems Prone to Moisture Variations

Majid Ghayoomi
University of New Hampshire

45% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

The proposed research will develop a mechanistic framework to improve robustness of the load restriction decision process especially during flooding. Through use of mechanistic relationships, the proposed research will enhance the pavement load capacity assessment and implement this methodology within a system dynamics framework.

NRRA Intelligent Construction Team

Contract Duration — Initial / Extension

Seismic Approach to Quality Management of HMA

Park Seismic, LLC
Choon Park

6% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

This contract is to develop a seismic data acquisition system and associated software package capable of acquiring surface wave data in a non-destructive, non-contact, rolling and multichannel fashion for the purpose of swiftly and reliably determining and visualizing seismic velocity of newly-constructed asphalt pavement layers for quality management purposes.

Support Importing, Viewing and Analysis of Dielectric Constant Data in Veta

The Transtec Group
George Chang

1% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

Veta is a map-based tool for viewing and analyzing geospatial data, currently including intelligent compaction (IC), paver-mounted thermal profiling (PMTP), and laser test rolling. This contract allows for dielectric data to be entered into the veta system like density profile system data collected on HMA pavement surfaces for density. This task has been re-prioritized by MnDOT to allow other high priority features to be completed for Veta 6.0. This feature is expected to be completed once MnDOT includes it in the next prioritized Veta feature list and when the dielectric constant manufacutrer provides their data files in the AASHTO MP39-19 format.

NRRA Intelligent Construction Team

Contract Duration — Initial | Extension

Validation of Electronic Truck Delivery Ticketing of HMA Material

		2017	2018	2019	2020	2021	2022
SRF Consulting	**100%**						
Joe Korzilius	Complete						

Technology Transfer - This study pilots the use of electronic delivery tickets (E-Ticket) for reporting the delivery of HMA material. E-Tickets identify the tonnage and type of HMA material produced, when and how much HMA is deposited into the truck, location of the truck, arrival time, time stamps when the truck leaves the plant, arrives at the project, arrives at the paver.

Evaluation of Levels 3-4 Intelligent Compaction Measurement Values (ICMV) for Soils

		2017	2018	2019	2020	2021	2022
The Transtec Group	**10%**						
George Chang	Complete						

This contract will evaluate Level 3-4 ICMVs for soils subgrade and aggregate subbase compaction to take IC to the next level. There is an immediate need to further develop IC both nationally and on a local level. State research personnel will use the tools delivered under this contract to further develop and refine draft specifications. The contract amendment no. 1 is expected to include a 6-month no-cost extension to allow flexibility to complete the research field tests in the 2021 construction season.

NRRA Rigid Team

Contract Duration — Initial / Extension

Reduced Cementitious Material in Optimized Concrete Mixture

Iowa State University Peter Taylor	80% Complete	2017	2018	2019	2020	2021	2022

MnROAD test sections were built in 2017 to evaluate the effects of using less cement in concrete pavements. The objectives include to better understand early-age characteristics, assess potential durability issues, identify possible effects on long tern serviceability and economics, and develop recommended specifications for mixing and placement practices.

Solutions to Mitigate Dowel/Tie-Bar Propagated Cracking

ARA, Inc. Shreenath Rao	8% Complete	2017	2018	2019	2020	2021	2022

The goal of this project is to identify the cause(s) and contributing factors of concrete pavement longitudinal and delamination cracking caused by dowel and/or tie-bars. A literature review will be done along with review of case studies. Analytical and/or laboratory experiments will be used to develop solutions that mitigate this type of cracking in the future.

Construction Report for Jointless FRC Roundabout in Minnesota

Iowa State University Peter Taylor	50% Complete	2017	2018	2019	2020	2021	2022

2018 a roundabout was built near ___ Minnesota along with two FWD whitetopping projects using fiber reinforced concrete without expansion joints. The objectives of the study incuded the development of a construction reports, performance monitoring over three years, and a final report with recommendations on this type of construction practice.

Incorporation of Joint Faulting Model into BCOA-ME

University of Pittsburgh Julie Vandenbossche	Contracting	2017	2018	2019	2020	2021	2022

Contracting - A Bonded Concrete Over Asphalt (BCOA) is a tool used by many highway agencies. The effort here includes updating a faulting model used in the BCOA-ME design procedure. Currently NRRA is tieing to an existing PennDOT project to include other climatic conditions outside of Pennsyvaina so other states will have full access to the updated design program.

Performance of Concrete Overlays over Full Depth Reclamation (FDR)

ARM of Minnesota Tumer Akakin	Contracting	2017	2018	2019	2020	2021	2022

Contracting - This research will review the viability of using concrete over FDR treated layers. FDR is typically used with a HMA surface but what about concrete? Concrete pavement design over FDR is not fully established and needs to be better understood how this type of roadway maybe used in cold regions.

NRRA Rigid Team

Design and Performance of Unbonded PCC Overlays

SRF Consulting Joe Korzilius	95% Complete	2017	2018	2019	2020	2021	2022

Technology Transfer - The objective of this tech transfer project is to compile and report a synthesis of design methods NRRA Member states use for design, identify best practices, and report successful and unsatisfactory experiences with performance, case studies.

Repair of Joint Associated Distress Pavements

SRF Consulting Joe Korzilius	2% Complete	2017	2018	2019	2020	2021	2022

Technology Transfer - short technical brief and webinar containing the best practices for the repair of distressed joints in concrete pavements and overlays. This will include causes for the distresses, as well as case histories of successful and non-successful repair methods. A webinar will also be developed, delivered, and recorded. Status on hold till a Iowa State contract is done.

Compacted Concrete for Local Streets

Missouri University Kamal H. Khayat	30% Complete	2017	2018	2019	2020	2021	2022

Missouri DOT constucted test sections in the fall of 2018 south of St Louis Missouri. They also contacted the University to analyze the data and track the performance. NRRA contributed sensors and a TAP to help with the evaluation of this product. CCP uses a high-density asphalt type paver to lay the concrete followed by a light roller, a riding trowel and a broom finish.

Evaluation of Long-Term Impacts of Early Opening of Concrete Pavements

University of Pittsburgh Lev Khazanovich	80% Complete	2017	2018	2019	2020	2021	2022

MnROAD test sectons were built in 2017 to evaluate the visible and non-visible immediate and long-term damage caused by early age loading of concrete. The goals are to quantify the effect of early loading damage on long-term performance and determine minimum strength at opening or other measurable variables associated with this common issue with concrete construction.

Performance Benefits of Fiber-Reinforced Thin Concrete Pavement and Overlays

U of M Duluth Manik Barman	80% Complete	2017	2018	2019	2020	2021	2022

MnROAD test sections were built in 2017 to gain a better understanding the benefits of using fibers in concrete pavements. The objectives of this study are to determining contribution of fibers in reducing panel fatigue cracking, determining contribution of fibers in mitigating joint faulting, and determining optimal panel size.

NRRA Rigid Team

Contract Duration — Initial / Extension

Effect of Low and Moderate Recycled Concrete Aggregate Replacement Levels on Concrete Properties

University of St. Thomas Rita Lederle	Contractnig	2017	2018	2019	2020	2021	2022

Contracting - This study will determine how the use of higher strength and stiffness coarse aggregates such as taconite or granite blended with RCA and marginal aggregates affects the properties of concrete for paving. This will help reduce the demand for increasingly scarce traditional aggregates and provide a means of using more marginal and recycled aggregates.

NRRA Flexible Team

Contract Duration — Initial / Extension

Mix Rejuvenator Test Sections (Phase II)

RFP — Contracting

2017 | 2018 | 2019 | 2020 | 2021 | 2022

2019 MnDOT along with rejuvenator suppliers built 8 test sections on TH-6 near Emily MN. MnDOT documented the construction, will monitor the performance, and take additional cores for future testing. The goals of the project is to evaluate and recommend how rejuvenators can be effectively used to to allow more recycled asphalt pavement to be utilized in the HMA pavements.

Innovative Practical Approach to Assessing Bitumen Compatibility as a Means of Material Specification

Unuiversity of New Hampshire
Eshan V. Dave

0% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

The primary objectives are to develop a practical and implementable characterization system to determine compatibility between virgin asphalt binder and recycled asphalt pavement, build a methodology select appropriate asphalt binders and additives, define threshold values and criteria, provide guidance on implementation based material selection methodology.

Cold Asphalt Recycling Technologies using Rejuvenating Asphalt Emulsion

Cargill Bioindustrial
Hassan Tabatabaee

Contracting

2017 | 2018 | 2019 | 2020 | 2021 | 2022

Call for Innovation - The objectives of this study are to evaluate the efficacy of rejuvenating asphalt emulsions in the CIR and/or CCPR process in terms of potential performance benefits relative to existing stabilization options using concepts of balanced mixture design, provide preliminary usage and design guidelines, and develop a “roadmap” for implementation.

Mix Rejuvenator Synthesis (Phase I)

WSB Consultants
Andrea Blanchette

100% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

Tech Transfer - The objective of this project is to identify the types of mix rejuvenators available and their performance to date. This project also aims to determine the benefits and effectiveness, in terms of performance and cost, to serve as guidance in decision making. This synthesis will gather the experience and knowledge from the NRRA state members regarding their current use.

NRRA Flexible Team

Longitudinal Joint Construction Performance

		2017	2018	2019	2020	2021	2022
WSB	**100%**						
Sheue Torng Lee	Complete						

Technology Transfer - HMA pavements are typically built in "lanes" which the edges are more difficult to compact than the rest of the lane. The goal is to compile research and specifications from each NRRA state to help improve consturction practices so ashalt mix density is consistent for the whole lane and we have less longitudinal joints distress on our roadways.

Tack Coats

		2017	2018	2019	2020	2021	2022
WSB	**100%**						
Sheue Torng Lee	Complete						

Technology Transfer - The purpose of this tech transfer project is to compile a synthesis of best practices being used by NRRA members in the area of tack coats and to identify any gaps in the research that can be filled during the next round of construction activities at MnROAD.

Developing Best Practices for Rehabilitation of Concrete with Hot Mix Asphalt (HMA)

		2017	2018	2019	2020	2021	2022
University of New Hampshire	**60%**						
Eshan V. Dave	Complete						

2017 MnROAD constructed 12 test sections to better understand the reflective cracking of asphalt overlays of concrete. Laboratory performance testing and monitoring has also been done. The goal is to develop a best practices for rehabilitation of PCC with asphalt overlays that incorporates field performance data, performance modelling, and life cycle cost analysis.

Cold Central Plant Recycling (CCPR)

		2017	2018	2019	2020	2021	2022
American Engineering Testing	**80%**						
Derek Tompkins	Complete						

2017 MnROAD constructed two different CCPR methods (foam and emulsion) with 2 different asphalt based surfaces Hot Mix Asphalt (HMA) overlay and double chip seal - 4 test sections. The project will be evaluating this type of pavement layers and their effectiveness related to laboratory, construction practices, costs, and utimatly pavement performance.

NRRA Preventive Maintenance Team

Contract Duration — Initial | Extension

Service Life Enhancement of Substrates Overlaid with Thin Overlays

WSB Consultants
Sheue Torng Lee

85% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

The goal of this project is to utilize applicable analytic methodology to evaluate the service life enhancement of flexible substrates overlaid with thin overlays, which include ultra-thin bonded wearing course (UTBWC), chip seals, and micro-surfacing. First, the PI will coordinate with the NRRA member states

Concrete Pavement Restoration (CPR) for Bonded Concrete Overlays of Asphalt

WSB Consultants
Sheue Torng Lee

93% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

BCOA pavements can help to enhance the structural capacity and rideability of existing asphalt pavement. CPR techniques have been used widely to repair traditional concrete pavements, but these techniques may be or may not be applicable to BCOA. The objective of this project is to develop a synthesis of best practices being used by NRRA state members in repairing these roads

Spray on Rejuvenator Test Sections

RFP out in April 2020

2017 | 2018 | 2019 | 2020 | 2021 | 2022

This project will include tests sections in Minnesota with industry partnerships related to spray applied rejuvenators on a newer HMA pavement. RFP is being developed to do the lab testing and analysis of the data collected over the study. MnDOT will preform monitoring on the test sections.

Bio-Materials Maintenance Treatments

Iowa State University
Ashley Buss

0% Complete

2017 | 2018 | 2019 | 2020 | 2021 | 2022

Call for Innovation - The objectives are to enhance pavement longevity by using bio-based materials to soften oxidized asphalt at the surface of the pavement and sealing up cracks in the surface to prevent water infiltration. Enhance development of soybean-derived bio-materials for pavement maintenance applications.

NRRA Preventive Maintenance Team

Contract Duration — Initial | Extension

Pavement preservation approaches for lightly surfaced roadways

SRF Consulting
Joe Korzilius

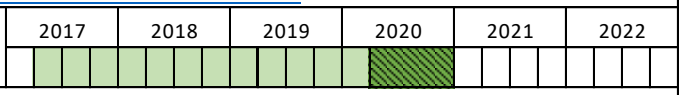
20% Complete

Technology Transfer - The objective of this tech transfer project is to compile and report a synthesis of design methods NRRA Member states use for design, identify best practices, and report successful and unsatisfactory experiences with performance, case studies. Will tie to MN LRRB efforts/training for implementation activities. TAP to evaluate more on future activities.

Surface Characteristics of Diamond Ground PCC Surfaces

SRF Consulting
Joe Korzilius

95% Complete

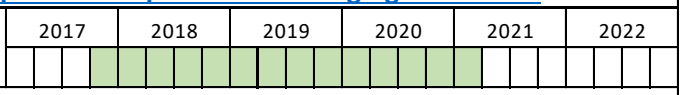


Technology Transfer - The objective of this project is to determine the change in surface characteristics of diamond ground textures for both new and existing pavements. This project will explore the state of practice of diamond grinding PCC surfaces and the benefits.

Effective Long Lasting Partial Depth Joint Repairs for Challenging Conditions

Braun Intertec
Heidi Olson

70% Complete

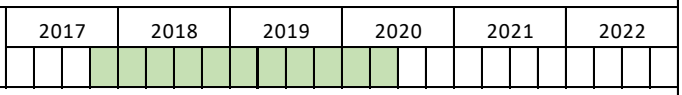


This project will provide a guide for State and other agencies to establish an effective joint repair program. The final report will guide State through product selection, installation techniques, equipment needed for completing the repair, typical performance cost, along with the life expectancy of the repair products. MnROAD test sections established in October 2017.

Maintaining Poor Pavements

SRF Consulting
Joe Korzilius

Complete

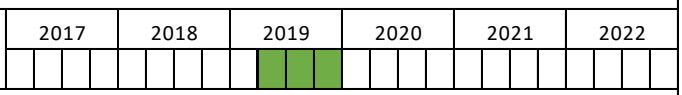


Summarize practices being performed in various states related to thinner rehabilitation treatments applied to poor condition pavement, intended to extend service life. The focus is to provide guidance on improvements that are not high priority to justify a full reconstruction. Project placed on hold 2/20/2020 becuase of limited data received from agencies. See website.

Spray on Rejuvenator Synthesis

WSB Consultants
Sheue Torng Lee

90% Complete



Technology Transfer - The objective of this project is to document the field projects constructed to evaluate spray on rejuvenators by NRRA members, NCAT, NCHRP, LRRB. The final report should serve as a work plan for the rejuvenator test sections.