

TechBrief

The Asphalt Pavement Technology Program is an integrated national effort to improve the long-term performance and cost-effectiveness of asphalt pavements. Managed by the Federal Highway Administration through partnerships with State highway agencies, industry, and academia, the program's primary goals are to reduce congestion, improve safety, and foster technology innovation. The program was established to develop and implement suggestions, methods, procedures, and other tools for asphalt pavement materials selection, mixture design, testing, construction, and quality control.

Office of Preconstruction,
Construction, and
Pavements

FHWA-HIF-24-095

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U.S. Department of Transportation
Federal Highway Administration

Accelerated Implementation and Deployment of Asphalt Pavement Technologies Featured Products

This Technical Brief summarizes products of a cooperative agreement on accelerated implementation and deployment of asphalt pavement techniques and the number of times they were uniquely accessed by stakeholders prior to publication of the Technical Brief.

The contents of this document do not have the force and effect of law and are not meant to bind the public in any way. This document is intended only to provide clarity to the public regarding existing requirements under the law or agency policies.

Introduction

The Development and Deployment of Innovative Asphalt Pavement Technologies (DDIAPT) Cooperative Agreement No. 693JJ31850010 between the Federal Highway Administration (FHWA) and the University of Nevada Reno (UNR) generated numerous products of beneficial use to the U.S. Government, State Departments of Transportation (DOTs) and other asphalt industry stakeholders. The products should also be considered as public resources available to anyone. Many of the products support the FHWA Strategic Plan 2022-2026, which in turn supports the US DOT Strategic Plan 2022-2026 (1, 2). The DDIAPT products were developed and disseminated over the 5-year cooperative agreement period. Examples of specific products include: technical reports, technical briefs, 1-page fact sheets, webinars, videos, workshops, peer exchanges, conference and technical meeting presentations, and webpages.

Much of the information used to develop the DDIAPT products was obtained through the cooperative agreement team interaction with State DOT and other entity staff that were evaluating, advancing, or had implemented innovative asphalt pavement technologies. The interactions took place via site visits, virtual site visits, workshops, peer exchanges, and webinars.

Many of the DDIAPT products are in the form of resources that FHWA and State DOTs can use to contribute to strategic goals, strategic objectives, and key performance indicators throughout the life of the U.S. DOT and FHWA Strategic Plans 2022-2026 (1, 2) strategic plans. Various DDIAPT products can also be used to support the Federal Sustainability Plan, FHWA Sustainable Pavements Program, and the U.S. General Services Administration (GSA) new asphalt and concrete standards for GSA construction, modernization, and paving projects (3, 4, 5).

Products from DDIAPT cooperative agreement on accelerated implementation and deployment of asphalt pavement techniques were summarized, along with the number of times they were accessed prior to the publication of this technical brief. “Accessed” is defined as a unique access to a product from the UNR DDIAPT Publications or Webinar Series webpages. The cooperative agreement products were also posted on FHWA webpages. However, information on the number of times they were accessed from the FHWA webpages was not available at the time of publication.

The target audience of the cooperative agreement products was a broad group of asphalt pavement stakeholders including: State DOTs, FHWA, metropolitan planning organizations (MPO), engineering firms (design, construction, construction management, quality control, and quality assurance), asphalt mixture producers and contractors, asphalt binder producers, asphalt plant manufacturers, paving equipment manufacturers and academia.

The objectives of this TechBrief are to:

1. share a high-level summary the DDIAPT products developed through the cooperative agreement,
2. report the number of unique times each product was accessed, and
3. illustrate examples of how the DDIAPT products support the USDOT and FHWA Strategic Plans 2022-2026.

The FHWA-23-073 contains links to the publications, videos and webinars associated with the cooperative agreement (6). The UNR DIAPT Publications webpage currently has links to 55 products and the UNR DIAPT Webinars webpage has links to 19 recorded webinars (6, 7).

DDIAPT Cooperative Agreement Structure

The DDIAPT cooperative agreement structure included the following six innovation areas:

- A. Materials
- B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems
- C. Design, Specifications and Practices
- D. Pavement Preservation (PP) Specifications and Practices
- E. Real Time Pavement Production and Construction Controls
- F. Forensic Support and Asphalt Testing to Support Stakeholders

Each innovation area had a number of tasks associated with it, which were also defined in the cooperative agreement. Subtasks within an innovation area task were performed and what led to development of the DDAIPT products. In the Fall of each contract year potential subtasks were identified and a one paragraph description was developed for initial FHWA consideration. There were always more proposed subtasks than available resources. FHWA reviewed the proposed subtask descriptions and provided feedback on them. The coop team then developed a one-page statement of work (SOW) for each proposed subtask that received positive feedback along with a proposed priority ranking of the SOWs. The SOWs identified the specific products a subtask would generate. Work was initiated on the tasks selected in that year once approved

Table 1 shows innovation areas A and B, along with the titles of tasks and subtasks. The task and subtask nomenclature used was a single letter and single number to identify a task (e.g. B.1) and a single letter and two numbers to identify a subtask (e.g. B.1.1). The title of subtask B.1.1 is Document Field Performance and RAP Best Practices. Multiple products could be developed in each subtask depending on the type work and information generated. For example, for subtask B.1.1 Document Field Performance and RAP Best Practices a technical report, technical brief, 1-pager, and a webinar were products developed. Table 2 shows innovation areas D, E, and F along with the titles of tasks and

subtasks. Table 3 shows innovation area C along with the titles of tasks and subtasks. There were no subtasks performed in Innovation Areas A or F. There were nine subtasks in Innovation Area B, fifteen in Innovation Area C, one in Innovation Area D, and two Innovation Area E.

Table 1. Innovation Areas A and B Work Plan Tasks and Subtasks.

Innovation Area	Tasks & Subtasks	Title
A. Materials	A.1	Advancement of Innovative Binders for Asphalt Pavement Systems
	A.2	Other New & Innovative Materials as Agreed Upon
B. Resource Responsible (RR) use of Materials for Flexible Pavement Systems	B.1	High Reclaimed Asphalt Pavement (RAP) Mixtures
	B.1.1	<i>Document Field Performance and RAP Best Practices</i>
	B.1.2	<i>Document Field Performance and Cold Asphalt Recycling Best Practices</i>
	B.2	Reclaimed Asphalt Shingles (RAS) Modified Binders and Mixtures
	B.2.1	<i>Practices and Lessons Learned When Using Reclaimed Asphalt Shingles in Asphalt Mixtures</i>
	B.3	Asphalt Rubber-Modified Binders
	B.3.1	<i>Resource Responsible Use of Recycled Tire Rubber in Asphalt Pavements</i>
	B.3.2	<i>Effective use of GTR Modified Asphalt Binder in Asphalt Mixtures</i>
	B.4	Other New & Innovative RR Systems
	B.4.1	<i>Responsible use of Re-refined Engine Oil Bottoms (REOB) and Polyphosphoric Acid (PPA)</i>
	B.4.2	<i>Recycled Materials and Warm-Mix Asphalt Usage (2020)</i>
	B.4.3	<i>Recycled Materials and Warm-Mix Asphalt Usage (2021)</i>
	B.4.4	<i>Recycled Materials and Warm-Mix Asphalt Usage (2022)</i>

Table 2. Innovation Areas D, E, and F Work Plan Tasks and Subtasks.

Innovation Area	Tasks & Subtasks	Title
D. Pavement Preservation (PP) Specifications and Practices	D.1	New and Innovative PP Specifications and Practices
	D.1.2	<i>Reduce Cutbacks in Pavement Maintenance and Preservation</i>
E. Real-Time Pavement Production and Construction Controls	E.1	New and Innovative Real-Time Production and Construction Controls
	E.1.1	<i>Review of Paver-Mounted Thermal Profiler and Density Profile System Using Ground Penetrating Radar</i>
	E.1.2	<i>Intelligent Construction Equipment QA Data Validation</i>
F. Forensic Support and Asphalt Testing to Support Stakeholders	F.1	Asphalt Pavement Analysis, Binder and Mixture Testing, and Data Analysis
	F.2	On-Site Field Investigations

Table 3. Innovation Area C Work Plan Tasks and Subtasks.

Innovation Area	Tasks & Subtasks	Title
C. Design, Specifications, and Practices (DS&P)	C.1	Asphalt Mixture Performance Based Design Technical Refinement and Deployment Support
	C.1.1	<i>AMPT and PRS Training</i>
	C.1.2	<i>Barrier Analysis to AMPT and PRS</i>
	C.1.3	<i>Informational Brief on Performance and Index Based Tests</i>
	C.1.4	<i>Document Case Studies and Practices for Implementation of BMD</i>
	C.1.5	<i>Asphalt Performance-Related Specifications (PRS) – A 2020 RoadMap for Moving Forward</i>
	C.1.6	<i>Document Practices for Asphalt Mixture Adjustments to Meet Performance Test Requirements</i>
	C.1.7	<i>Balanced Mix Design (BMD) Case Studies Virtual Workshop: Moving Forward with Implementation</i>
	C.1.8	<i>Balanced Mixture Design Peer Exchange Meetings – PART I & II</i>
	C.2	Deployment and Technical Support of Refined Superpave Binder Specification
	C.2.1	<i>Incorporate MSCR, ΔT_c, etc. into the Specification</i>
	C.3	Technical Support of Refined Superpave Volumetric Mixture Design & Specification
	C.4	Increased Pavement Density Initiative Support
	C.4.1	<i>Asphalt Density Educational Materials</i>
	C.4.2	<i>Support Delayed Asphalt Density Efforts</i>
	C.4.3	<i>Density Specification Focused Review</i>
	C.5	Deployment and Technical Support of MSCR Binder Specifications
	C.5.1	<i>Technical Brief and Virtual Workshop: Delta Tc Binder Specification Parameter</i>
	C.6	Deployment and Technical Support of Delta Tc Binder Parameter and Specifications
	C.6.1	<i>Technical Brief and Virtual Workshop: Low-Temperature Rheological Parameters</i>
	C.7	Asphalt Materials Quality Assurance Practices
	C.7.1	<i>Technical Brief and Virtual Workshop: Asphalt Materials Quality Assurance Practices</i>
	C.8	Other New and Innovative DS&P As Agreed Upon
	C.8.1	<i>Advances in the Design, Production, and Construction of Stone Matrix Asphalt (SMA)</i>
	C.8.3	<i>Asphalt Carbon Footprint Reduction Workshop</i>

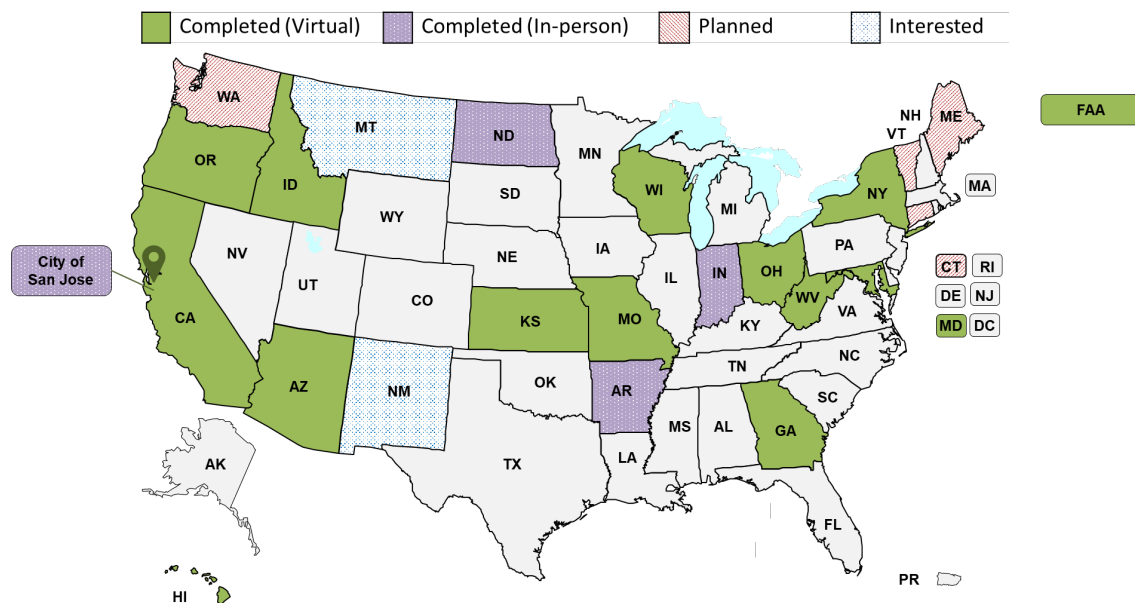
Type and Number of Products Developed per Innovation Area

Table 4 is a summary of the type and number of products developed in each innovation area that included subtasks. Recall that there were no subtasks in Innovation Areas A and F, thus there are no products identified for them. A significant portion of the cooperative agreement products were developed in Innovation Areas B and C. The most common products were workshops, technical reports, tech briefs, and webinars. Innovation Area C. Design, Specifications and Practices included workshops and peer exchanges. The workshops were associated with Subtask C.1.7 Balanced Mix Design (BMD) Case Studies Virtual Workshop: Moving Forward with Implementation. A total of 18 BMD workshops were

held, with four in-person and 14 virtually, engaging 689 participants. Figure 1 shows the extent of the locations represented in BMD workshops across the country. Subtask C.1.8 Balanced Mix Design Peer Exchanges were high-impact events as multiple states participated in each of the five held as illustrated in Figure 2.

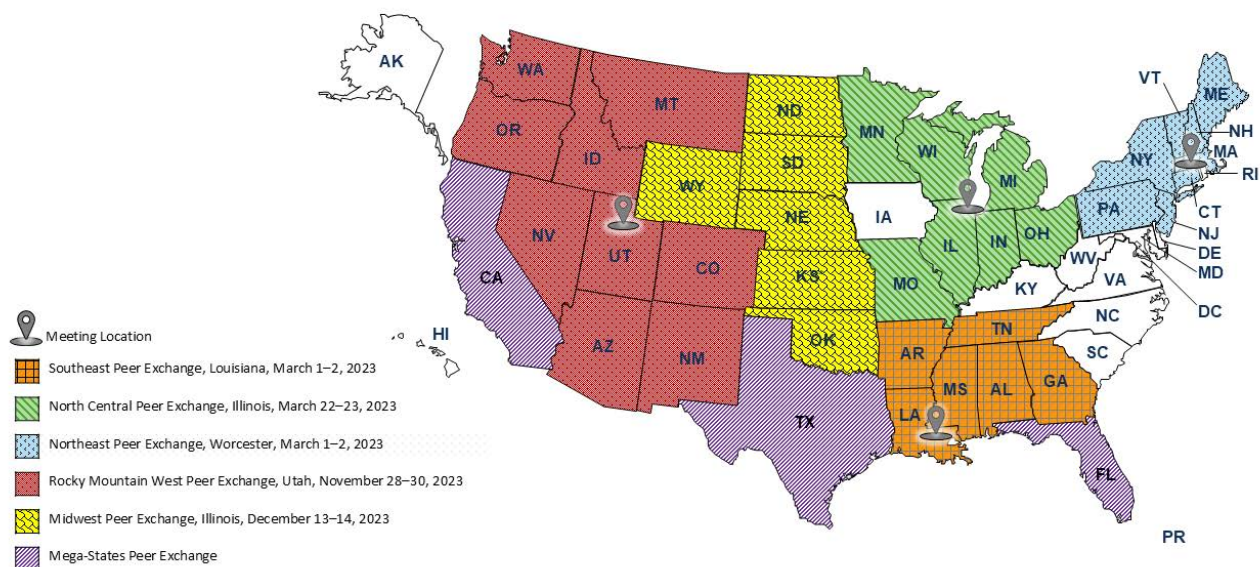
Table 4. Type and Number of Products Developed per Innovation Area.

Innovation Area	Workshops	Peer Exchanges	Technical Reports	Tech Briefs	Case Study Reports	NAPA Reports	White Papers	Webinars	1-Pagers	Videos
A. Materials	0	0	0	0	0	0	0	0	0	0
B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems	0	0	5	4	0	3	0	8	4	0
C. Design, Specifications and Practices	18	5	4	12	7	0	0	10	3	8
D. Pavement Preservation (PP) Specifications and Practices	1	0	0	0	0	0	1	0	0	0
E. Real Time Pavement Production and Construction Controls	0	0	1	0	0	0	0	1	1	0
F. Forensic Support and Asphalt Testing to Support Stakeholders	0	0	0	0	0	0	0	0	0	0
<i>Totals</i>	<i>19</i>	<i>5</i>	<i>10</i>	<i>16</i>	<i>7</i>	<i>3</i>	<i>1</i>	<i>19</i>	<i>8</i>	<i>8</i>



Source: University of Nevada Reno

Figure 1. Delivered and Planned BMD Workshops.



Source: University of Nevada Reno

Figure 2. Map of participating State DOTs and Federal Lands Offices.

Figure 3 through Figure 6 show examples of the number of times Innovation Area B, C, D and E publications were uniquely accessed (visits) at the time of publication. The solid bars represent the total number of visits. The vertically striped bars represent visits by persons in the U.S. and the horizontally striped bars represent visits by persons in other countries. Figure 7 shows a summary of publication visits for all of the innovations areas with the total being 33,397 unique visits.

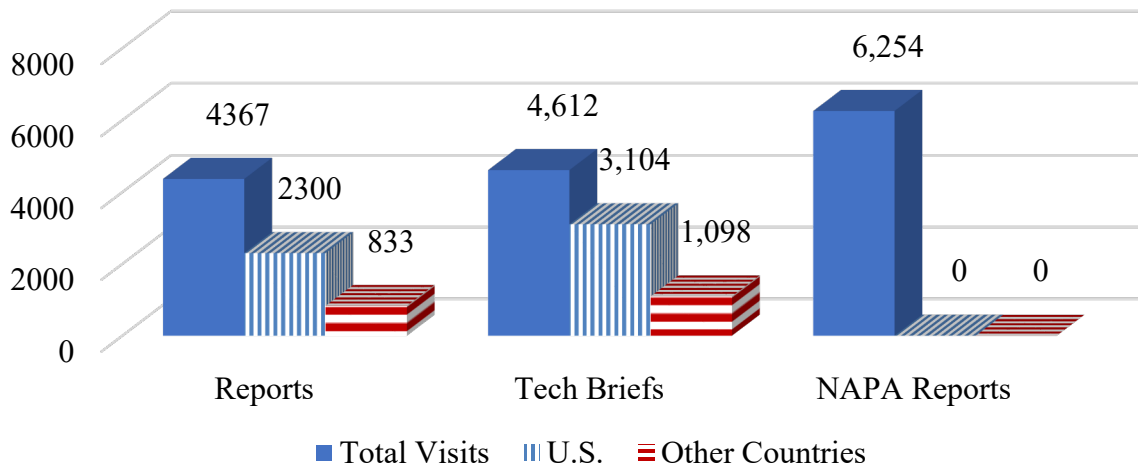


Figure 3. Innovation Area B Publications Visits.

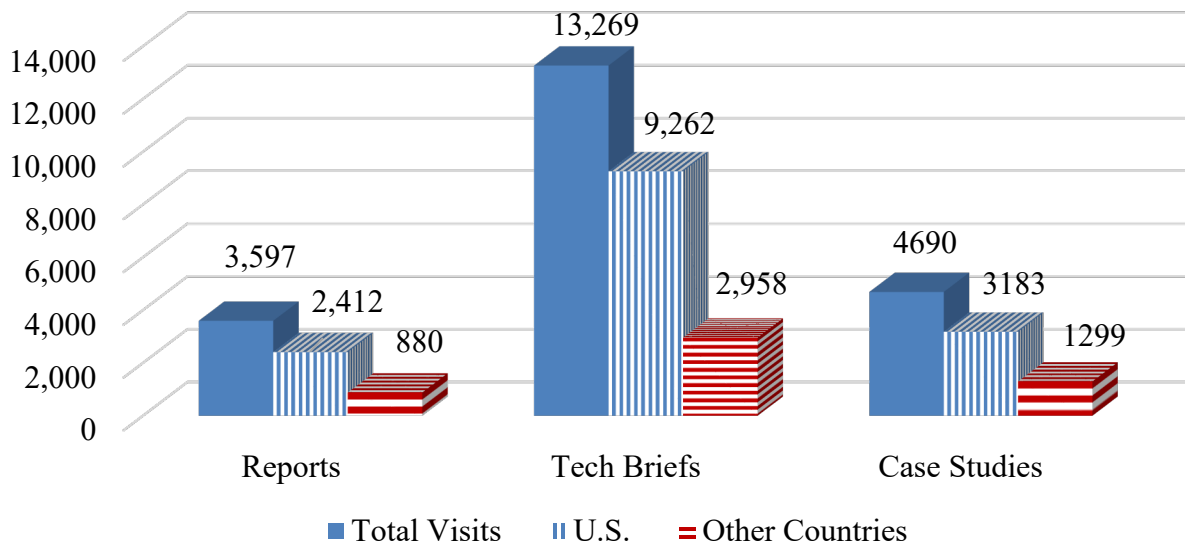


Figure 4. Innovation Area C Publications Visits.

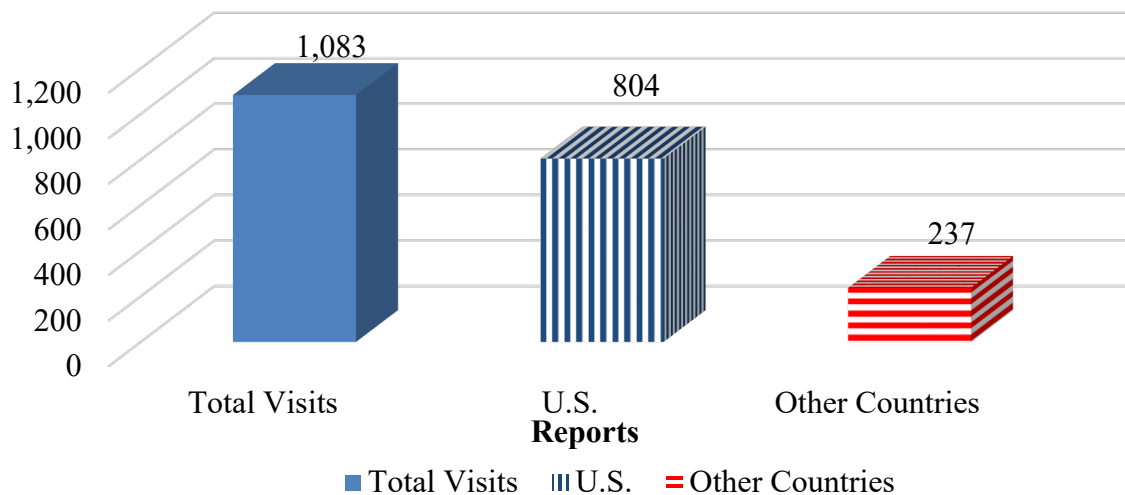


Figure 5. Innovation Area D Publications Visits.

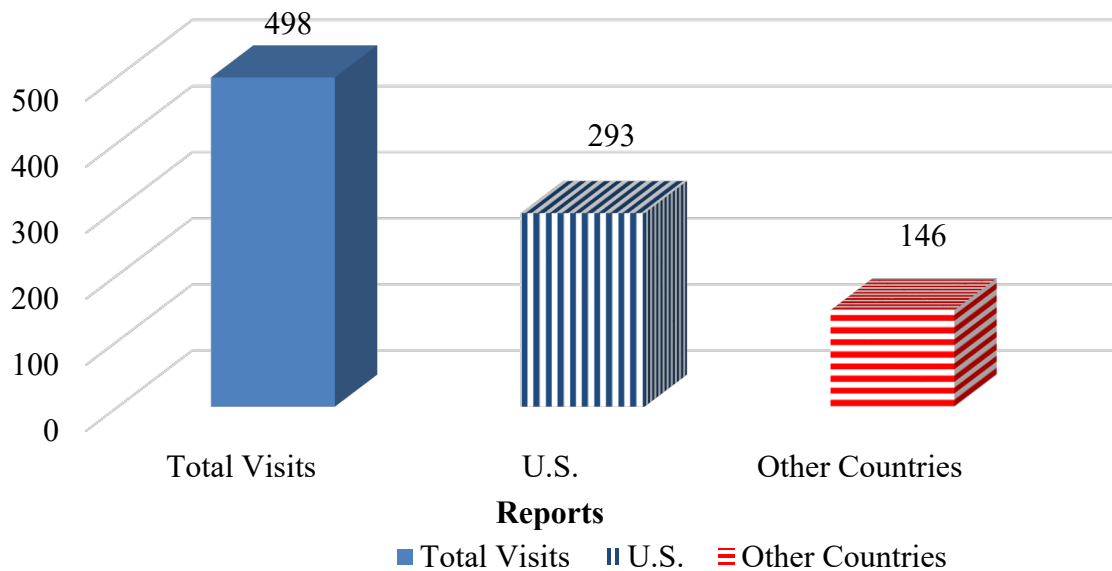


Figure 6. Innovation Area E Publications Visits.

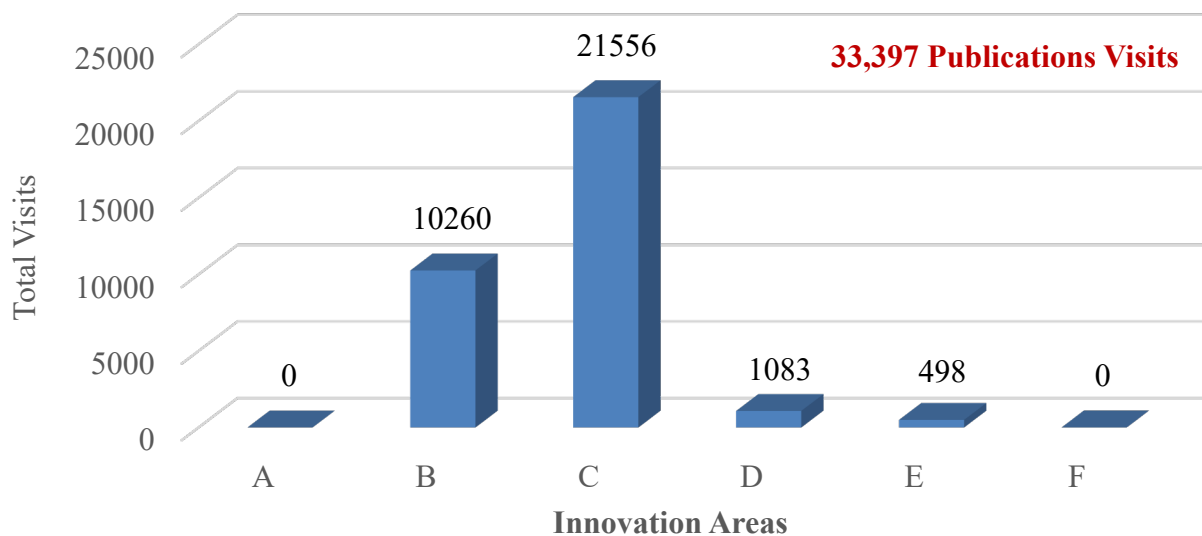


Figure 7. Summary of All Innovation Area Publications Visits.

Figure 8 through Figure 11 show examples of the number of times Innovation Area B, C, D and E webinars were uniquely accessed (visits) at the time of publication. The solid bars represent the total number of visits. The vertically striped bars represent visits by persons in the U.S. and the horizontally striped bars represent visits by persons in other countries. The checkered bars represent the number of live webinar participants. Figure 12 shows a summary of webinar visits and participants for all of the Innovations areas, the total being 33,397 unique visits.

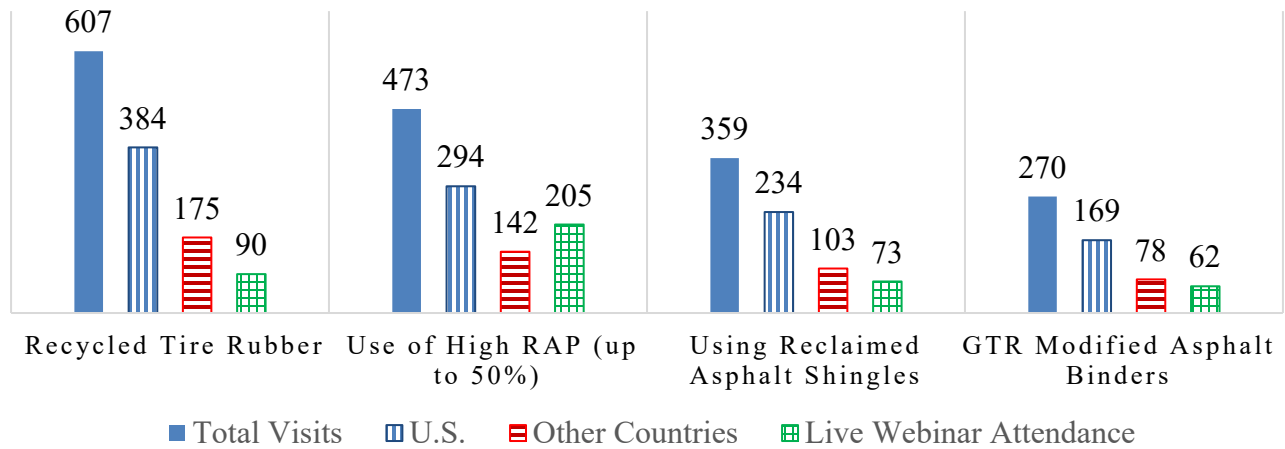


Figure 8. Innovation Area B Webinar Visits.

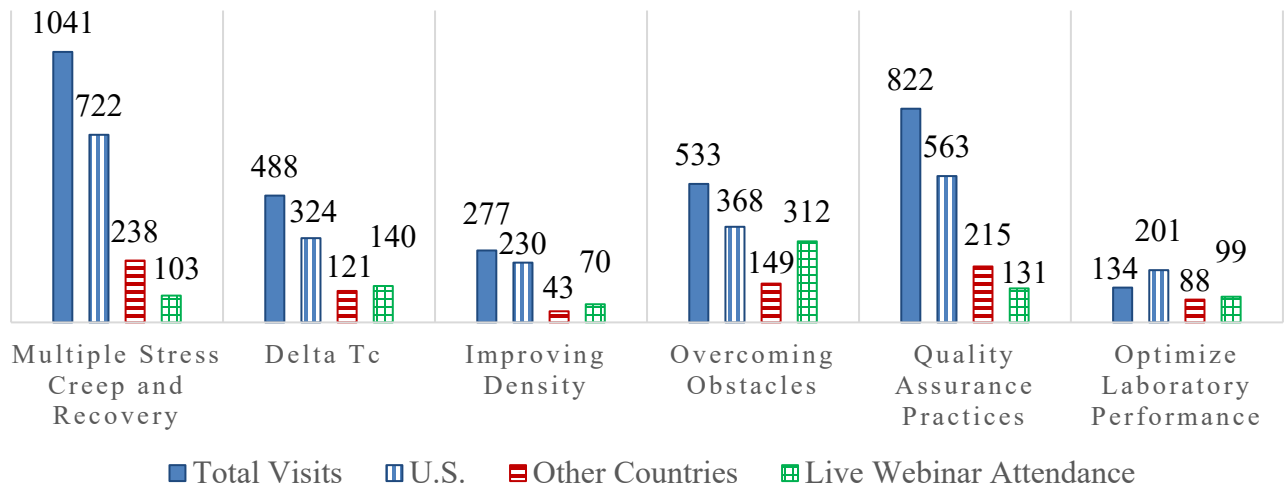


Figure 9. Innovation Area C Webinar Visits.

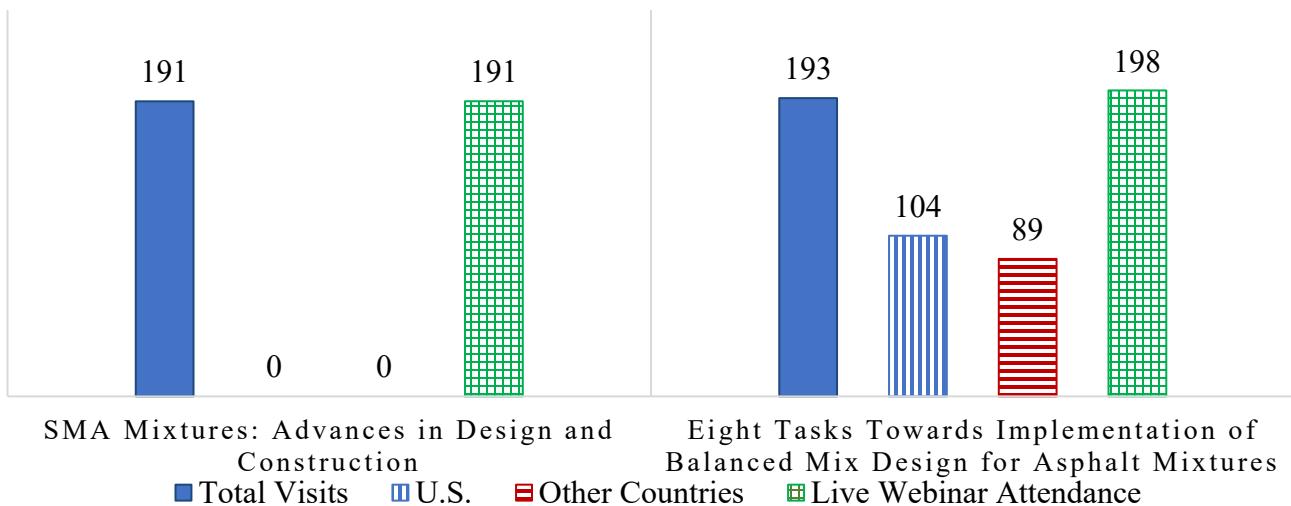


Figure 10. Innovation Area C Webinar Visits.

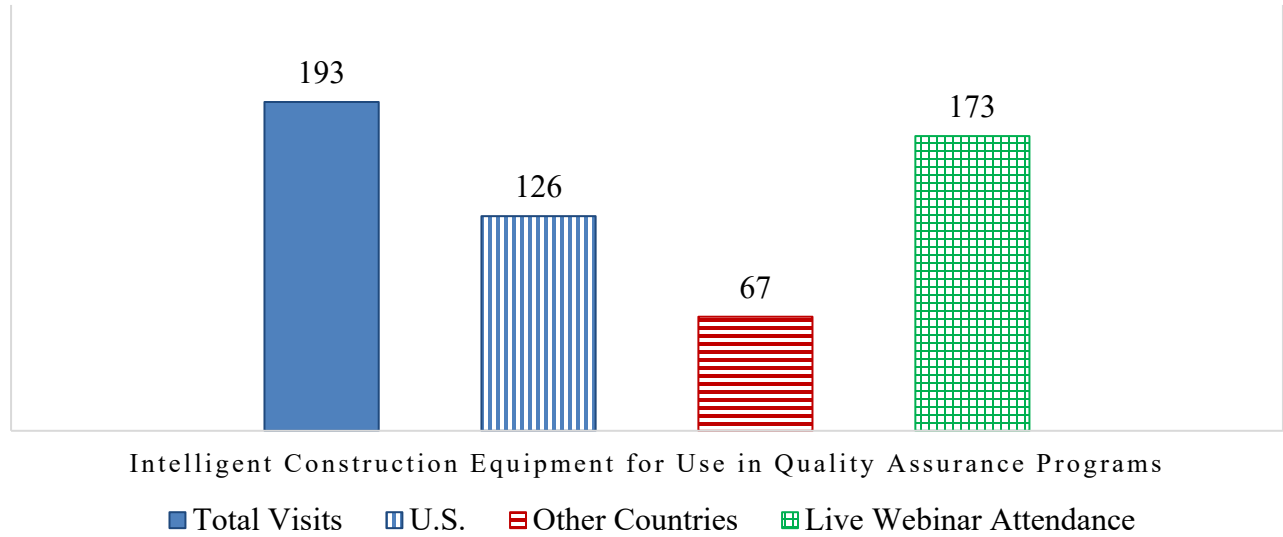


Figure 11. Innovation Area C Webinar Visits.

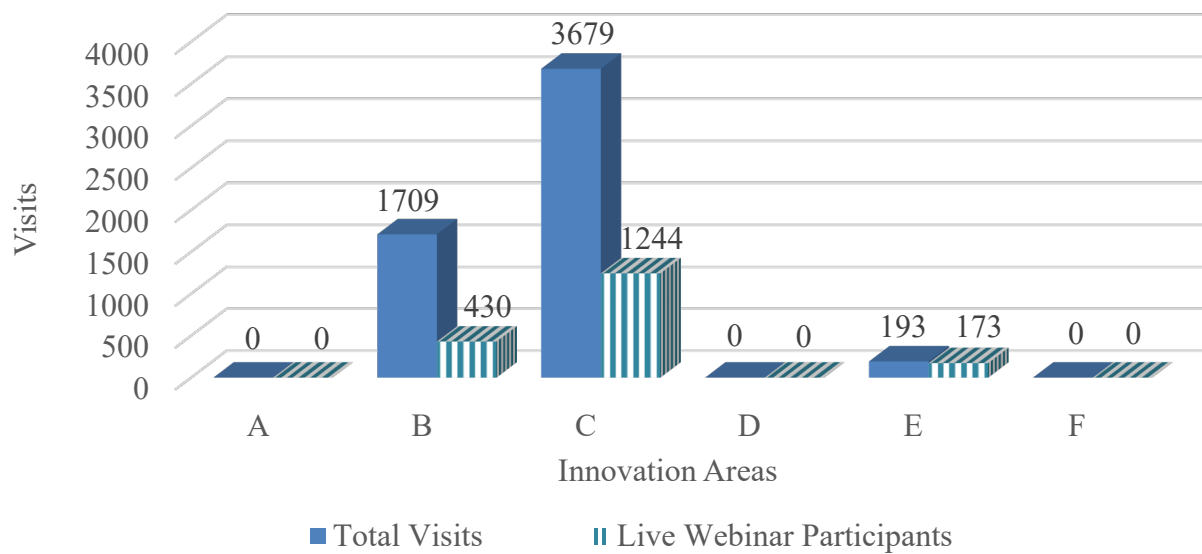


Figure 12. Webinars by Innovation Areas.

Figure 13 shows the number of unique AMPT and BMD video views for Innovation Area C. Figure 14 shows the summary of video views for all innovation areas.

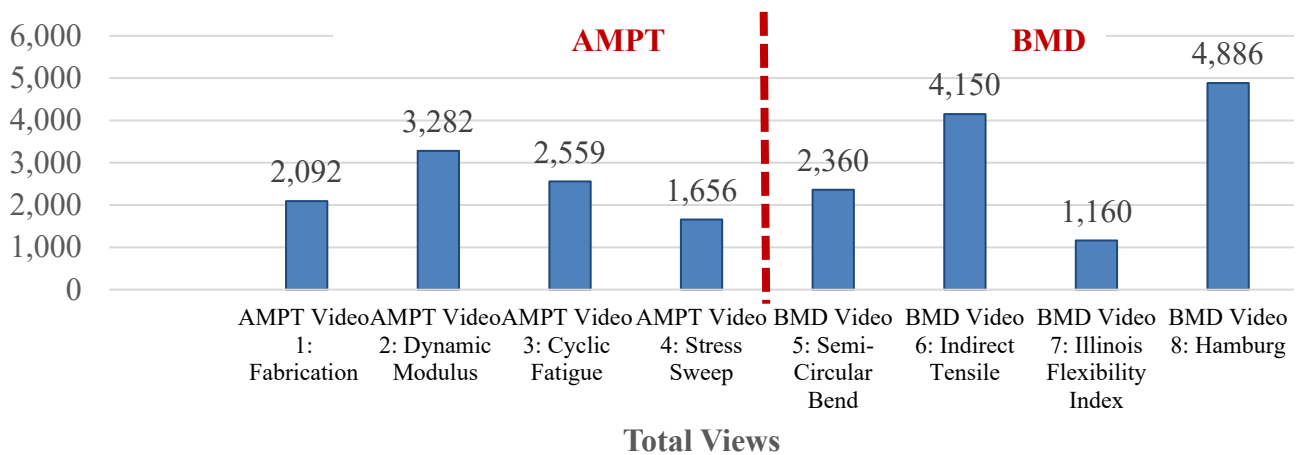


Figure 13. Innovation Area C Video Visits.

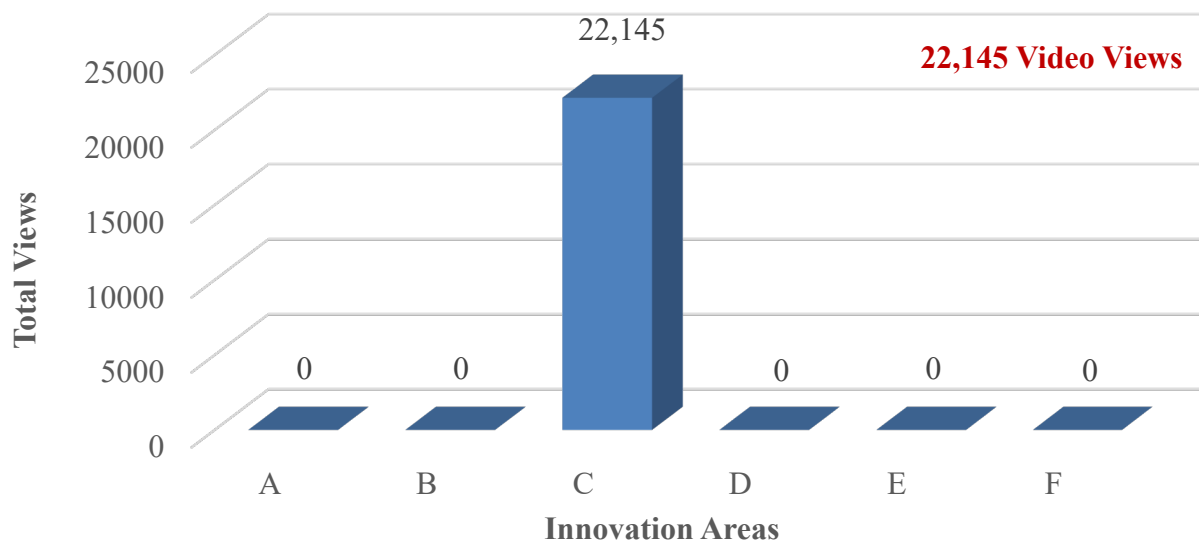


Figure 14. Total Video Views by Innovation Areas.

Relationship between DDIAPT Products and U.S. DOT and FHWA Strategic Plans 2022-2026

The cooperative agreement products were mapped to the U.S. DOT Strategic Plan 2022-2026 and FHWA Strategic Plan 2022-2026 to illustrate how the products support these strategic plans. Both strategic plans include strategic goals, strategic objectives and key performance indicators. The FHWA strategic plan is informed by the U.S. DOT strategic plan and thus, they have identical strategic goals and strategic objectives. Several of the strategic plan key performance indicators (KPIs) are identical also. However, there are some key performance indicators that are different between the two strategic plans.

Table 5 is a high-level summary of the strategic goals and strategic objectives that are identical in the U.S. DOT strategic plan 2022-2026 and FHWA strategic plan 2022-2026 (1, 2). The last column of the table identifies DDIAPT innovation areas with tasks that generated products which support both of the strategic plans. Strategic goals and strategic objectives italicized in Table 5 are those which the DDIAPT

cooperative agreement led to development of products which support them.

Table 5. U.S. DOT and FHWA Strategic Plans 2022-2026 Strategic Goals and Strategic Objectives.

Strategic Goals	Strategic Objectives	DDIAPT Innovation Areas with Task Products Supporting Strategic Goals and Objectives
<i>Safety</i>	<ul style="list-style-type: none"> • <i>Safe Public</i> • <i>Safe Workers</i> • <i>Safe Design</i> • Safe Systems • Critical Infrastructure Cybersecurity 	B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems C. Design, Specifications and Practices E. Real Time Pavement Production and Construction Controls
<i>Economic Strength and Global Competitiveness</i>	<ul style="list-style-type: none"> • Job Creation and Fiscal Health • <i>High-Performing Core Assets</i> • Global Economic Leadership • <i>Resilient Supply Chains</i> • System Reliability and Connectivity 	B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems C. Design, Specifications and Practices D. Pavement Preservation (PP) Specifications and Practices E. Real Time Pavement Production and Construction Controls
Equity	<ul style="list-style-type: none"> • Expanding Access • Wealth Creation • Power of Community • Proactive Intervention, Planning, and Capacity Building 	Not Applicable
<i>Climate and Sustainability</i>	<ul style="list-style-type: none"> • <i>Path to Economy-wide Net-Zero Emissions by 2050</i> • <i>Infrastructure Resilience</i> • Climate Justice and Environmental Justice 	B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems C. Design, Specifications and Practices D. Pavement Preservation (PP) Specifications and Practices E. Real Time Pavement Production and Construction Controls
<i>Transformation</i>	<ul style="list-style-type: none"> • <i>Matching Research and Policy to Advance Breakthroughs</i> • <i>Experimentation</i> • Collaboration and Competitiveness • Flexibility and Adaptability 	B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems E. Real Time Pavement Production and Construction Controls
Organizational Excellence	<ul style="list-style-type: none"> • Customer Service • Workforce Development • Data-Driven Programs and Policies • Oversight, Performance, and Technical Assistance • Sustainability Initiatives • Enterprise Cyber Risks 	Not Applicable

Table 6 only includes U.S. DOT strategic plan 2022-2026 and FHWA strategic plan 2022-2026 strategic goals and strategic objectives for which the DDIAPT cooperative agreement developed products which support them. The last column of the table identifies DDIAPT innovation areas with tasks that generated products which support both of the strategic plans. The last column also includes the number of each product type within the innovation areas. The information in Table 5 and Table 6 clearly shows that the DDIAPT cooperative agreement resulted in many products (resources) which can be used by agency and industry stakeholders.

Table 6. U.S. DOT and FHWA Strategic Plans 2022-2026 Strategic Goals and Strategic Objectives.

Strategic Goals	Strategic Objectives	DDIAPT Innovation Areas Task Product Types and Numbers Supporting Strategic Goals and Strategic Objectives and KPI's
Safety	<ul style="list-style-type: none"> • Safe Public • Safe Workers • Safe Design 	B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems: <i>5 Technical Report, 4 TechBriefs, 1 White Paper, 8 webinars, and 2 1-pagers.</i> C. Design, Specifications and Practices: <i>18 Workshops, 5 Peer Exchanges, 3 Technical Reports, 12 TechBriefs, 7 Case Studies, 10 Webinars, 1 1-pagers and 8 videos</i> E. Real Time Pavement Production and Construction Controls: <i>1 Technical Report, 1 Webinar</i>
Economic Strength and Global Competitiveness	<ul style="list-style-type: none"> • High-Performing Core Assets • Resilient Supply Chains 	B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems: <i>5 Technical Report, 4 TechBriefs, 1 White Paper, 8 webinars, and 2 1-pagers.</i> C. Design, Specifications and Practices: <i>18 Workshops, 5 Peer Exchanges, 3 Technical Reports, 12 TechBriefs, 7 Case Studies, 10 Webinars, 1 1-pagers and 8 videos</i> D. Pavement Preservation (PP) Specifications and Practices: <i>1 Technical Report</i> E. Real Time Pavement Production and Construction Controls: <i>1 Technical Report, 1 Webinar</i>
Climate and Sustainability	<ul style="list-style-type: none"> • Path to Economy-wide Net-Zero Emissions by 2050 • Infrastructure Resilience 	B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems: <i>5 Technical Report, 4 TechBriefs, 1 White Paper, 8 webinars, and 2 1-pagers.</i> C. Design, Specifications and Practices: <i>18 Workshops, 5 Peer Exchanges, 3 Technical Reports, 12 TechBriefs, 7 Case Studies, 10 Webinars, 1 1-pagers and 8 videos</i> D. Pavement Preservation (PP) Specifications and Practices: <i>1 Technical Report</i> E. Real Time Pavement Production and Construction Controls: <i>1 Technical Report, 1 Webinar</i>
Transformation	<ul style="list-style-type: none"> • Matching Research and Policy to Advance Breakthroughs • Experimentation 	B. Resource Responsible (RR) Use of Materials for Flexible Pavement Systems: <i>5 Technical Report, 4 TechBriefs, 1 White Paper, 8 webinars, and 2 1-pagers.</i> E. Real Time Pavement Production and Construction Controls: <i>1 Technical Report, 1 Webinar</i>

Summary

Products from a FHWA and the (UNR) cooperative agreement on accelerated implementation and deployment of asphalt pavement techniques were summarized, along with the number of times they were accessed prior to the publication of this technical brief. “Accessed” is defined as a unique access to a product from the UNR DAIPT Publications or Webinar Series webpages. The cooperative agreement products were also posted on FHWA webpages. However, information on the number of times they were accessed from the FHWA webpages was not available at the time of publication. The products were developed and disseminated over a 5-year period. Examples of specific products include: technical reports, technical briefs, 1-page fact sheets, workshops, peer exchanges, webinars, and videos. The target audience of the cooperative agreement products was a broad group of asphalt pavement stakeholders including: State DOTs, FHWA, metropolitan planning organizations (MPO), engineering firms (design, construction, construction management, quality control, and quality assurance), asphalt mixture producers and contractors, asphalt binder producers, asphalt plant manufacturers, paving equipment manufacturers and academia.

The information was presented consist with the DDIAPT cooperative agreement structure which included six innovation areas. Each innovation area included tasks and subtasks that led to the development of the cooperative agreement products. Summary statistics were presented on the number of products delivered and how many times they were uniquely accessed. The cooperative agreement products were also mapped to the U.S. DOT Strategic Plans 2022-2026 and FHWA Strategic Plans 2022-2026 illustrating how the cooperative agreement products support these strategic plans.

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Accelerated Implementation and Deployment of Asphalt Pavement Technologies Featured Products

Contact — For more information, contact Federal Highway Administration (FHWA):

Office of Preconstruction, Construction, and Pavements

Tim Aschenbrener — timothy.aschenbrener@dot.gov

Researcher — This technical Brief was developed by Adam Hand (University of Nevada Reno), Tim Aschenbrener (FHWA), Harold Von Quintas (ARA) and Praveen Gopiseti (ARA) as part of FHWA's Development and Deployment of Innovative Asphalt Pavement Technologies cooperative agreement. The TechBrief is based on information described within the document.

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