OREGON DEPARTMENT OF TRANSPORTATION

RESEARCH, DEVELOPMENT, AND TECHNOLOGY TRANSFER PROGRAM

Annual Report Fiscal Year 2022

RESEARCH

Oregon Department of Transportation

OREGON DEPARTMENT OF TRANSPORTATION

RESEARCH, DEVELOPMENT, AND TECHNOLOGY TRANSFER PROGRAM

Annual Report Fiscal Year 2022

Oregon Department of Transportation
Research Section
555 13th Street NE, Suite 1
Salem OR 97301

March 2023

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 WHO WE ARE

The goal of the Research Section is to foster innovation within the Oregon Department of Transportation (ODOT) by researching, developing, testing, and evaluating new and innovative transportation products, materials, methods, and processes.

Research and development has been an integral part of our business for nearly a century. The Federal Aid Highway Act of 1921 created the Research and Technology program within what is now the Federal Highway Administration (FHWA). The same bill earmarked resources to create what would become the Highway Research Board (now the Transportation Research Board - TRB) within the National Academy of Sciences. Section 11 of the Hayden Cartwright Act of 1934 laid groundwork for the Highway Planning and Research (HP&R) program in all state departments of transportation by designating that "*1/2 per centum of the amount apportioned for any year to any State...may be used for surveys, plans, and engineering investigations....*" Largely because of the HP&R (later SP&R) program, research has been an integral activity at ODOT and in most other states for nearly 100 years.

Historically, research efforts in ODOT have been primarily focused in areas relating to highway materials and construction. Only to varying degrees have these activities been distinct from other engineering and testing work done within ODOT's materials laboratory. In fact, until sometime in the 1980s, the titles of the State Materials Engineer and the State Research Engineer were held by the same person. The agency's transition from a Highway Department to a Department of Transportation in 1969 and the Inter-modal Surface Transportation Efficiency Act of 1991 have brought about a gradual diversification of ODOT's research agenda. Research has changed from a focus on highways and construction materials to a much broader agenda that includes a greater diversity of highway topics as well as other modes of surface transportation. In 1996, the Research program was moved from the Highway Division to the Policy Data and Analysis Division, in part to consolidate administration of the SP&R program, but also to better serve a broader customer base within the agency.

Since that time, the Research Section has expanded, diversifying its research projects to include the following general categories:

- Active and Sustainable Transportation,
- Construction and Maintenance,
- Freight and Economic Analysis,
- Geotechnical Hydrology Environmental Science and Engineering

- Pavement and Materials,
- Structures,
- Traffic Safety and Human Factors,
- Transportation Operations Technology

The ODOT Research Section oversees transportation research projects and, through the Technology Transfer (T2) Center, provides transportation-related information to local agencies throughout Oregon. The mission of the section is to contribute to improvement in the performance of the transportation system by studying ways to enhance processes, methods, or materials in use. The section also works with technical experts and agency personnel to support research implementation.

The staff includes the Research Manager, the T2 Center Director, the T2 Center Training Coordinator, eight research coordinators, an executive support assistant, three part-time trainers, and a limited duration, part-time Safety Circuit Rider.

1.2 THE WAY WE DO BUSINESS

ODOT research projects seek to address identifiable problems or issues with the goal of providing significant benefits to the department by reducing costs, increasing efficiency, addressing environmental concerns, enhancing safety, improving productivity, improving the mobility of Oregonians, or providing better service. Transportation problems or issues may be identified by anyone and are formally presented to the Research Section as *problem statements*. Each year these statements are reviewed by the section and other agency personnel to determine priorities for projects. Top projects receive research funding in order of priority.

The majority of direct funding for ODOT research projects is provided by the FHWA State Planning and Research (SPR) Program, Part 2. In recent years, a small portion of SPR planning funds have also been utilized. A few additional projects are financed entirely using state highway funds. Indirect costs, including facilities, office supplies and equipment, employee training, utilities, etc. are also paid for with state funds.

Project collaboration is an important element of the research program, and most research projects involve many levels of collaboration, not just funding. A small percentage of ODOT research projects are conducted in-house by Research Section staff. The section more often works with external principal investigators, most frequently those affiliated with universities. While the majority of research is performed by an outside organization, Research Section staff provide management and coordination services. Project coordination involves collaboration between the principal investigator, other researchers, and technical specialists within the agency. The project coordinator manages a technical advisory committee, composed of knowledgeable individuals from FHWA, ODOT, and other state agencies.

1.3 CONTENTS OF THIS REPORT

For Fiscal Year 2022 this report documents the research projects we completed (Section 2); a review of the implementation of projects completed 5 years ago (Section 3); research publications, progress, and spending (Section 4); other research activities (Section 5). Length limitations preclude an in-depth description of every research project. Instead, the focus of this report is on projects of general interest, representative of a range of topics, and expected to be of the highest value to ODOT.

If you have questions about the contents of this report or about any aspect of research at ODOT, please feel free to contact the Research Section as follows:

ODOT Research Section
555 13th Street NE
Salem, OR 97301-6867

Telephone: 503-986-2700
Website: oregon.gov/ODOT/Programs/Pages/Research.aspx

2.0 COMPLETED PROJECTS

Pursuant to 23 CFR 420.209 (a)(6), the State must have procedures for documenting RD&T activities through the preparation of final reports. Each completed research project results in a report that documents the data collected, analyses performed, conclusions, and recommendation. This section lists the projects completed in Fiscal Year 2022. Table 2.1at the end of this section lists the published report number and publication date. All completed projects listed below resulted in a final report that is available online at: https://www.oregon.gov/ODOT/Programs/Pages/Research-Publications.aspx

SPR 822 Speed Variation and Safety in Work Zones

In addition to lower speeds, the difference between vehicle speed and the average speed on the roadway has been identified as a factor in roadway crashes. For work zones, the potential for such speed variation from the average speed is magnified. The safety associated with speed variation in work zones affects both motorists driving through the work zone and the workers in the work zone. The overall goal of this research is to develop additional knowledge and practices that can be used to improve driver and worker safety in work zones and, as a result, mobility through work zones. The research focuses on high-speed roadways (e.g., highways and freeways) and typical mobile construction and maintenance operations that occur on such roadways (e.g., paving and re-striping). The research presented in this report involved a review of the archival literature germane to the topic of speed variation (with and without a work zone), the analysis results of speed variation and crash occurrence, and the impacts of selected traffic control interventions on speed variation in work zones in Oregon. The PCMS unit showing alternating messages “MAINTAIN CONSTANT SPEED” and “THRU WORK ZONE” in two phases and placed at the advance warning area was found to effectively reduce speed variation in the work zone. Based on the findings, the researchers recommend use of PCMS units that display custom messages to maintain constant speed for work zone operations on high-speed roadways.

SPR 808 Enhanced Assessment of Projected Landslide Activity Under Precipitation and Seismicity

Regional assessments of potential landsliding are useful means of mitigating loss of life, property, and infrastructure, especially when exacerbated by rainfall and seismic events. Susceptibility maps are useful tools for characterizing hazard and risk tied to potential landslides. The method presented herein enables characterization of the area, volume, and distribution of discrete landslide shapes, informing enhanced susceptibility analyses. The method also enables consideration of destabilizing forces from seismic and rainfall events. A new age-roughness curve for the Pacific Northwest constrains physical drivers linked to individual landslides from a landslide inventory, enabling more refined consideration of landslide driving forces during 3D forensic analyses. This further enhances susceptibility analyses by providing refined distributions of soil shear strength. The methodologies herein are validated by comparing rainfall-induced susceptibility to known landslides from a landslide inventory and by comparing empirical relationships between area and volume, developed using the proposed methodology, to empirical relationships found in literature. Finally, susceptibility maps are used to produce hazard maps, linking susceptibility and the probability of driving events, and a suite of coarse risk metrics. These risk metrics include maps and profiles showing closure times, repair costs, commodity losses, and rerouting costs associated with ODOT right-of-way (ROW). The analyses herein also provide useful tools for resilience planning.

SPR 826 Constructing High Performance Asphalt Pavements by Improving in Place Pavement Density

Increasing the density of asphalt concrete materials is expected to result in significant economic and environmental benefits by increasing asphalt mix strength and reducing cracking and rutting. In addition, reduced air-void content is expected to reduce permeability and moisture-induced pavement damage. Reduced permeability is also expected to reduce asphalt mix aging in the field and mitigate top-down cracking, which is currently the most critical distress type in Oregon. Improved cracking performance is expected to result in reduced life cycle costs, increased pavement condition ratings, and reduced roughness for the Oregon roadway network.

This research study provided information and guidelines for ODOT to implement in asphalt mixture design to achieve high density and better compactibility during construction. Current Contractor Mix Design guidelines (suggested limits for filler contents, gyration levels, etc.) are expected to be modified based on the findings of this research study. Pilot sections with high densities (95-96%) were suggested to be constructed by using the asphalt mixes designed by following the findings of this research study. Long-term performance of pilot sections should be monitored by automated pavement condition surveys (performed every two years by ODOT) to further evaluate the impact of high density on rutting and cracking resistance. Using the results of this study, cost and performance benefits of using high-density mixes were quantified by life-cycle cost analysis (LCCA). Environmental impact of using warm-mix asphalt and increased recycled asphalt pavement (RAP) content strategies on compactibility and cracking resistance was also quantified and evaluated by using pavement life-cycle assessment (LCA).

SPR 816 Resilient and Rapid Repair Measures for Seismically Vulnerable Bridges Following Major Earthquakes

The Cascadia Subduction Zone (CSZ) earthquake threatens bridges across the Pacific Northwest. Damage is expected to be geographically spread throughout the region and will have a nearly simultaneous impact on transportation through several important corridors. While bridge repair and replacement will ultimately be needed, priority will be placed on resuming mobility such that repairs will need to be implemented quickly. To anticipate this need, a repair method is being developed for rapid repair with the goal of achieving semi-permanent installation that also considers the different bridge damage states for future earthquakes. The proposed repair involves encasing the damaged column in a steel jacket, which is then anchored to the foundation through replaceable ductile fuse hold-downs. The design objective is to isolate all inelastic strains to the hold-downs thus creating a low-damage solution for the repaired columns.

Full-scale cyclic tests were conducted to investigate the cyclic performance on substandard column-to-foundation specimens. The proposed repair was applied to the damaged column and the specimen was then re-tested using the cyclic loading that is representative of CSZ demands. The experiments validated the design goal of achieving restored or controlled strength, while also exhibiting no additional damage and self-centering behavior. The proof-of-concept experiments have shown the potential of this methodology to rapidly repair earthquake-damaged columns with a relatively generic approach.

Retrofit details evaluated during this research projects will be provided in ODOT's upcoming "Seismic Design and Retrofit Criteria" under the preferred pre and post-earthquake retrofit strategies. We are considering to further test and evaluate this rapid repair measure as part of a pilot project. ODOT is currently scoping 12 bridges on I-5 for seismic retrofit and we will evaluate if any of those bridges will be a good candidate for this repair application.

SPR 823 Constructability and Durability of Concrete Pavements

Concrete for pavements must be proportioned so that the concrete is economical and durable. Because ordinary Portland cement (OPC) is the most costly component and is generally less durable than the aggregates, the OPC should be minimized. OPC significantly contributes to CO2 during manufacturing. Therefore, minimizing the OPC will also make the concrete greener. This research developed a mixture proportioning method to minimize the OPC content. This is achieved by characterizing the aggregates that will be use in the concrete to minimize the voids in the aggregates (fine and coarse). This will result in lower OPC requirements. This research assessed concretes proportioned with the new method. All concretes met edge slump and surface void requirements. All concretes met compressive and flexural strength requirements. Most concretes met formation factor requirements. Select testing indicates that shrinkage, as measured with shrinkage rings, is likely dependent on paste content; lower paste contents lead to lower shrinkage, but more research is needed. Select concretes did not perform well in freeze-thaw testing, however void spacing and size were not assessed.

TPF 5(371) Capacity Adjustment Factors for Connected and Automated Vehicles in the Highway Capacity

This project's objective was to develop capacity adjustment factors (CAFs) for connected and automated vehicles (CAVs) at different levels of market penetration to allow the HCM to be used to analyze CAV applications on freeways and urban streets. The primary approach to this problem was through an "agent-based" (i.e., fully customizable vehicle and driver behavior) simulation modeling framework in which CAV and non-CAV behavior could be modeled differently. The products of this research are highway capacity adjustment lookup tables and figures for different transportation system elements (e.g., freeways, roundabouts, signalized intersections) at different levels of CAV market penetration, and example scenarios demonstrating the application of the CAFs to planning studies.

This Transportation Pooled Fund Project included contributions from Arkansas, Connecticut, Florida, Indiana, Maryland, Oregon, North Carolina, Texas, Utah and Washington.

SPR 832 Expanding the Oregon Motor Carrier Safety Action Plan: Best Return on Investment

This study presents the results of an analysis on the impact of increased law enforcement on truck driver-at-fault crashes and identifies corridors that would make viable candidates for the Oregon MCSAP program. This was accomplished through a descriptive analysis of collected inspection data and Oregon crash data. Next, the safety performance of the program was determined by generating a safety performance function and estimated a crash modification factor. The safety performance analysis determined that the MCSAP program had a substantial impact on reducing truck driver-at-fault crashes. Using the crash modification factor, as well as estimates of the effects on law enforcement on truck driver-at-fault crash frequency, a benefit/cost analysis was conducted on several candidate corridors/segments. Three segments were identified as viable candidates for program expansion. Lastly, a survey was administered to law enforcement in Oregon to gauge their perception and willingness-to-adopt such a program in their jurisdiction. The project report provides ODOT with a comprehensive summary and recommendations.

Table 2.1: Research Reports Published in FY 2022

Report No.	Report Title	Date Published
FHWA-OR-RD-22-01	Speed Variation and Safety in Work Zones	7/6/2021
FHWA-OR-RD-22-02	Enhanced Assessment of Projected Landslide Activity Under Precipitation and Seismicity	7/14/2021
OR-RD-22-03	Use of Flashing Amber-White Lights on Paving Equipment in Work Zones	7/20/2021
FHWA-OR-RD-22-04	Constructing High Performance Asphalt Pavements by Improving in Place Pavement Density	8/30/2021
FHWA-OR-RD-22-05	Understanding Pedestrian Injuries and Social Equity	8/31/2021
FHWA-OR-RD-22-06	Understanding Pedestrian Injuries and Social Equity Literature Review	9/9/2021
FHWA-OR-RD-22-07	Resilient and Rapid Repair Measures for Seismically Vulnerable Bridges Following Major Earthquakes	9/30/2021
OR-RD-22-08	Measuring the Rates of Weight-Mile Tax Evasion in Oregon	10/25/2021
OR-RD-22-09	Undrained Shear Strength of Plastic Silt Subject to Blast-induced Excess Pore Pressures	12/7/2021
FHWA-OR-RD-22-10	Constructability and Durability of Concrete Pavements	1/11/2022
FHWA-OR-RD-22-11	Capacity Adjustment Factors for Connected and Automated Vehicles in the Highway Capacity Manual: Phase 1 and 2 Final Report	3/28/2022
FHWA-OR-RD-22-12	Expanding the Oregon Motor Carrier Safety Action Plan: Best Return on Investment	4/27/2022
FHWA-OR-RD-22-13	Coastal Landslide and Seacliff Retreat Monitoring for Climate Change Adaptation and Targeted Risk Assessment (Interim Report)	6/13/2022

3.0 FIVE YEAR REVIEW OF PAST PROJECTS

The Oregon DOT works to actively implement appropriate research findings and should document benefits to track the active implementation of appropriate research finding, projects completed five years ago are identified in this section. Where appropriate, findings and benefits are discussed. In particular this each project is assessed for the following implementation actions:

- Updates to ODOT documentation (e.g., policy, procedures, specifications, or other implementation documents) that have been updated as a result of this research.
- Use of the research to inform ODOT's position regarding any state statutes or administrative rules?
- Support of the work of national partners such as AASHTO, FHWA, to update national standards or guidance?
- Creation of a new program, position, or organizational unit?

This section of the report is part of Oregon's compliance with 23 CFR 420.209 (a)(5) , to determine the utilization of the State DOT's RD&T outputs, and of 23 CFR 420.209 (a)(6) documenting the department's efforts to implement appropriate research findings and benefits of our work.

All the completed projects listed below are available online at:
https://www.oregon.gov/ODOT/Programs/Pages/Research-Publications.aspx

SPR 762 – High-Strength Steel Reinforcing Bars
The High-Strength Steel (HSS) Reinforcing Bars project sought to increase ODOT's ability to take advantage of HSS reinforcement, specifically ASTM A706 Grade 80 (550). HSS reinforcement is permitted by the AASHTO LRFD Bridge Design Specifications for use in reinforced concrete bridge components in non-seismic regions. Using Grade 80 (550) steel reinforcement instead of Grade 60 (420) steel can reduce material and construction costs. However, state highway agencies (SHAs) only allow Grade 80 (550) reinforcing steel in bridge structural elements that are not expected to undergo large strain reversals during an earthquake. AASHTO and SHAs have concerns with using Grade 80 (550) reinforcement in elements designed for concrete shear interfaces and low cycle fatigue due to the lack of experimental data.

This project researched the performance of Grade 80 (550) steel under simulated seismic loading. One part of the project looked at resisting interface shearing actions, which is critical for characterizing the performance of precast girders and shear-keys in which Grade 80 (550) reinforcing steel may be used. Push-off test based experiments were performed on specimens designed using ASTM A706 Grade 60 (420) and Grade 80 (550) reinforcing steel. A total of twenty push-off specimens were constructed and tested to discern if proper designs can account for the nominal yield values of the higher strength-steel.

The project also examined the performance of Grade 80 (550) reinforcing steel under low cycle fatigue, which is crucial to provide designers with data on cyclic/seismic performance of bridge columns. Low cycle fatigue testing was performed to compare toughness fatigue life predictions for four types of reinforcing steel bar (ASTM A615 at Grade 60 and Grade 80, and ASTM A706 at Grade 60 and Grade 80). The results provide benchmark test data for ASTM A706 Grade 80 steel bars for use in design of compression members under flexural loading.

SPR 763 – Mechanistic Design Data from ODOT Instrumented Pavement Sites
ODOT instrumented three pavement sites between 2004 and 2008 to support efforts toward implementing mechanistic-empirical (M-E) pavement design. Data was collected as part of an earlier research project, however, the data reduction and analysis was not conducted and the response measurements are still considered to be in raw format. There was a need to evaluate the usefulness of the data and assess whether it can be useful for M-E design. There was also a need to develop user-friendly tools for ODOT to continue collecting and analyzing data to support M-E design. The primary objective of this research was to process existing data sets and evaluate their usefulness toward implementation of M-E design. A secondary objective was to develop user friendly processing schemes to facilitate future data processing and analysis.

Data processing algorithms and templates were developed for each test site that facilitated full processing of all the data to build databases representing each site. Investigation of site data found that most of the collected data could be successfully processed and observed trends in the data were as expected (e.g., seasonal changes affected pavement response). The location that compared rubblized base to aggregate base clearly demonstrated the effect of the rubblized base through a 50% reduction in strain at the bottom of the asphalt layer. Further investigations of the data may be warranted and user's guides for data reduction and analysis were provided that enable those investigations to proceed by ODOT staff.

This research contributed to ODOT's updated understanding of the concept of long-life pavement and has informed design decisions. For example, for the current North Corridor project in Bend, OR results of this research were used to corroborate the designed pavement thickness to confirm that 11 inches of asphalt could be a long-life pavement due to conditions in the area. This was a cost savings over national research indicating 12 inches.

SPR 770 – Impact of Cascadia Subduction Zone Earthquake on the Evaluation Criteria of Bridges
Subduction-zone earthquakes have occurred repeatedly in the Pacific Northwest, which lies near the Cascadia Subduction Zone (CSZ). Great subduction zone earthquakes are the largest earthquakes in the world and are the sole source zones that can produce earthquakes greater than M8.5. Such large earthquakes produce shaking with commensurately long durations. For this reason, existing reinforced concrete bridges are facing high seismic hazards that were not taken into account in original design. The seismic hazard used for bridge design and retrofit is defined by maps of ground acceleration values. The maps combine multiple regional sources of ground shaking using a Probabilistic Seismic Hazard Analysis (PSHA). Each source has different

characteristics of magnitude, probability of occurrence, and distance to a specific location of a structure.

One key source of ground shaking in PSHA in Oregon is the Cascadia Subduction Zone. However, the CSZ has several potential scenarios (M8.3 and M9.0) that have significantly different ground motion estimates as standalone events than can be expressed in the values derived from PSHA. In this study, a computer model called CSZ14 was developed to obtain the acceleration values expected from a full rupture CSZ event. These values were also compared to previous CSZ models as well as to the uniform hazard for various return periods from USGS hazard maps adopted in 2002. These 2002 maps continue to be used for the current design of bridges. The increased duration of a CSZ earthquake may result in more structural damage than would be expected based solely on the strength of ground shaking. The recent long duration subduction earthquakes that occurred in Maule, Chile (Mw 8.8, 2010) and Tohoku, Japan (Mw 9.0, 2011) are reminders of the importance of the effect of the duration of shaking on structural performance.

As part of the research on the potential impacts, the dynamic performance of circular reinforced concrete bridge columns was experimentally evaluated using shake-table tests by comparing the column response to crustal and subduction ground motions. Three continuous reinforced columns and three laps-spliced columns were tested using records from the 1989 Loma Prieta, 2010 Maule, and 2011 Tohoku earthquakes. The results demonstrated that duration of the motion can affect both the imposed damage and the displacement capacity of bridge columns.

SPR 777 – Chip Seal Design and Specifications

In 2015 the Oregon Department of Transportation (ODOT) started a research project that studied methods of ensuring the correct application of chip seals. The need for this research was partly due to the loss of experienced staff and contractors who understood the best application of chip seals for the variety of terrain and climates in Oregon. ODOT Construction Section currently hires contractors to apply chip seals, and ODOT Maintenance crews apply chip seals when needed.

Fourteen chip seal sections were constructed and monitored over two years in-service following ODOT specifications, which led to generally good and cost-effective performance in all sections. The chip seal application rates were documented and materials collected during construction were tested to obtain design application rates. Project findings support shifting to a new chip seal performance specification in Oregon

ODOT developed a new chip seal specification as a result of this research. At the time of its development, the performance portion of the specification was one of, if not the, first of its kind being implemented in the U.S. Based on the results from this research, Oregon received a Statewide Transportation Innovation Council (STIC) grant to assist in implementing the research finding. From the grant, we were able to develop a new chip seal performance/warranty specification, a chip seal design guide, and new test procedures associated with the specification.

SPR 778 Safety Effect on Pedestrian Crossing Enhancements

Over the last decade, the Oregon DOT and other agencies have systematically implemented many pedestrian crossing enhancements (PCEs) across the state. This study explored the safety performance of these enhanced crossing in Oregon. Detailed data were collected on 191 crossings. Though the study was missing exposure data (pedestrian traffic volume) researchers were still able to conclude safety improves for pedestrians by constructing a crash modification factor.

New approaches to planning and constructing transportation projects aims to base investments decisions on evidence-based approaches. Crash Modification Factors (CMFS) are developed through varying levels of before-and-after analysis that calculate the expected change in crashes following the construction of a given treatment. The Federal Highways Administration (FHWA) maintains the Crash Modification factor Clearinghouse which stores strongly vetted CMFS from across the world. CMFS based on this research have been accepted by the clearinghouse and and are are available for use.

SPR 779 – Risk Factors for Pedestrian and Bicycle Crashes
In 2013 there were 52 pedestrian and three bicyclist fatalities, with an additional 814 pedestrians and 922 bicyclists injured in that same year. The Oregon Department of Transportation (ODOT) has identified pedestrian and bicycle crashes as a primary focus for infrastructure funding, appropriating about $4 million annually to address this need.

The relative rarity of pedestrian/bicyclist crashes renders traditional crash history analysis unsuited for identifying areas of greatest risk. A risk-based criteria and method are best suited to identify sites of greatest threat for injury and death. This research project developed a tool for ODOT to identify and prioritize locations with increased or elevated risk for pedestrian and bicycle crashes based on elements of exposure and expectations of the severity of the outcome but not be dependent on crash history.

Based on modeling of exposure and outcome, the researchers created a risk-scoring tool for pedestrians and bicycles at intersections and road segments. The tool is implanted as a spreadsheet for ease of use. Application of the tool to intersection projects recommended under the All Roads Transportation Safety (ARTS) project demonstrated reasonable alignment with that program's more complex benefit-costs analysis process. This tool is included for use in the 2020 "Blueprint For Urban Design, ODOT's Approach for Design in Oregon Communities".

SPR 780 – Strategies to Increase the Service Life of Concrete Bridge Decks
Corrosion of the steel in reinforced concrete bridge decks is a critical issue for structures that are exposed to chloride-containing de-icing chemicals or marine salts. Oregon Department of Transportation (ODOT) has a large number of bridges that are vulnerable to this form of deterioration. An obvious indicator of a corrosion problem is visible damage; unfortunately, if corrosion damage is visible, the window for preventive action is likely closed. Pre-emptive actions and early detection of potential problems are more cost effective than repair or replacement of bridge decks that have already experienced corrosion.

In recent years, electrical-based methods have emerged as durability-related performance indicators for reinforced concrete structures. Several investigations have shown the existence of relationships between the electrical resistivity (or formation factor) of concrete and other durability-related parameters such as corrosion rate of steel reinforcement and transport properties of concrete. The main purpose of this research is to provide ODOT with a protocol to select bridges for its ongoing bridge deck treatment operations using quantitative tools that are practical and quick. To achieve the project goals, this project experimentally investigated the relationship between electrical properties of concrete (e.g. SR or formation factor), environmental data (e.g. temperature and relative humidity), and chloride ingress in reduced-size reinforced concrete slabs simulating bridge decks commonly used in Oregon. Experiments also explored the effect of freeze-thaw action on the observed relationship. A comprehensive modeling framework was developed that relates the electrical properties of concrete, environmental data and chloride ingress. This framework was then verified, and validated. A virtual test bed using the validated modeling framework was developed to conduct statistically significant number of virtual experiments. These results were used to obtain closed-form relationships between electrical properties of concrete, environmental data, and chloride ingress for bridge decks in different geographical areas in Oregon. Finally, a demonstration case study was performed to produce a closed-form equation and show how it can be used in a bridge-deck evaluation-protocol that can be used by ODOT in practice.

This particular research will be utilized as we develop a bridge deck program (on-going currently). When the deck program is fully developed there will be Bridge Design Manual language that may incorporate learning from this research, and it benefits preservation and stewardship.

SPR 781 – Improving Adaptive/Responsive Signal Control Performance: Implications of non-Invasive Detection and Legacy Timing Practice

This project collected and analyzed event based vehicle detection data from multiple technologies at four different sites across Oregon to provide guidance for deployment of non-invasive detection for use in adaptive control, as well as develop a true life cycle cost comparison of various detection sources. Background literature and surveys revealed that, while the performance of non-invasive detection products has improved as the technologies have matured, there are still documented performance issues, especially when it is attempted to replicate advanced functionalities of loop detectors using the same detection zone size. Non-optimal performance issues impact how practitioners choose to deploy detection technology, as well as continue to be the basis of funded research work to explore the extents of these performance differences. The project findings reccomend non-invasive detection sources should be used with caution for developing data for adaptive control, as the inherent nature of their operation differs from inductive loops. Also due to performance issues encountered with over 50% of the inductive loop detectors within this study, the report reccomends the development of continual detector health monitoring program.

The overall goal of the project was to determine better timing settings for the detections systems that would provide an apples-to-apples type result within the controllers in order to be able to better coordinate timing practices for coordinated systems as well as for isolated intersections. The project was unable to meet this goal due to the extreme differences found with the various non-invasive detections systems. Also, at the time there were aspects of the radar detection systems that were not actually working as represented by system manufacturers. While the goals of the research were not met, we did gain new insight that have been applied to later research projects. This project serves as an example of the value of research that provides an independent evaluation of a concept and the avoidance of large-scale deployment of flawed designs.

SPR 782 – HMAC Layer Adhesion Through Tack Coat

Asphalt cement applied between pavement lifts forms a tack coat which provides a bond between the two surfaces. Absence of this layer through poor application or tracking of material by construction vehicles creates a poor bond between layers. This research study was comprised of field studies, field and laboratory testing, finite element modeling and construction sampling of tack coat materials used in Oregon. Also, as part of the study, two new tack coat materials were investigated. Recommendations for tack coat material, application rates for tack coat spraying and construction practices were developed.

A set of tools to help reduce tracking were tested. Aids for quality control and quality assurance were addressed during this study by the development of a field torque tester and a field tack coat tester. These can be used to measure tack coat performance and were correlated to pavement core testing.

Several conclusions and recommendations related to surface conditions and material performance were made. ODOT is current pursuing a follow on project to further develop tack coat testing, application methods and tack coat materials with the intent to be able to provide guidance for changes in practice.

TPF 5-259 – Image Processing, Analysis, and Management Tools for Gusset Plate Connections in Steel Truss Bridges

After the collapse of the I-35W Bridge in Minnesota, inspection and rating of steel truss bridge gusset plate connections has become necessary for bridge owners to establish their adequacy. When trying to perform gusset plate connection ratings, transportation agencies have found a number of challenges. For example, the state of the practice for collecting dimensional information of connections is to acquire the data manually by visual inspection and conventional instruments. This approach is time consuming.

This project developed methods and tools to expedite gusset plate rating:

- Developed digital photographic methods to capture, correct perspective distortion, and measure connection dimensions;
- Extracted geometric features of the plate and fasteners from processed images;
- Implemented AASHTO-LRFD connection capacity calculations from the processed images;
- Developed open-source nonlinear finite element analysis of gusset plates as an alternative analysis approach; and

- Developed a GIS-based framework named Interactive Bridge Image Management (iBIM).

This project is a transportation pooled fund project led by the Oregon DOT and supported by FHWA, Wisconsin DOT, Idaho Transportation Department, Caltrans, Texas DOT, North Carolina DOT and and New York DOT.

4.0 PUBLICATIONS, ACTIVITY, AND SPENDING

The following section summarizes activities of the Research Section, including the status of active projects, cost information.

4.1 RESEARCH PROJECT STATUS

The status of 133 research projects initiated from FY 2010 through FY 2022 is summarized in Table 4.1. The reports published in FY 2022 are discussed in detail in Section 2 above. Table 4.2 summarizes the major projects that completed in FY 2022, and Table 4.3 documents the major projects continuing past FY 2022. Major projects are defined as those that were selected by the Research Advisory Committee or had a budget of at least $70,000 and lasted at least one year. Table 4.4summarizes all other research projects and related activities and includes the Research Discretionary Fund and miscellaneous continuing activities.

Table 4.1: Project Status Summary, FY 2010 – FY 2022

Project Start Fiscal Year	Inactive		Active		Total New Projects
	Complete	Cancelled	On Schedule	Behind Schedule	
2010	8	2	1	0	11
2011	11	0	1	0	12
2012	8	0	0	0	8
2013	13	0	0	0	13
2014	11	1	0	0	12
2015	11	0	0	0	11
2016	14	1	0	0	15
2017	9	0	1	0	10
2018	10	0	0	1	11
2019	8	1	1	1	11
2020	1	0	6	2	9
2021	0	0	10	1	11
2022	0	0	11	0	11
Total	104	5	31	5	145

Table 4.2: Expenditures and Status for Major Projects Ended During FY 2022

Project No.	Project Title	Spent in FY'2022	Publication Status	Status
SPR 822	Speed Variation and Safety in Work Zones	$151	Published	Complete
SPR 808	Enhanced Assessment of Projected Landslide Activity Under Precipitation and Seismicity	$0	Published	Complete
SPR 826	Constructing High Performance Asphalt Pavements by Improving in Place Pavement Density	$847	Published	Complete
SPR 816	Resilient and Rapid Repair Measures for Seismically Vulnerable Bridges Following Major Earthquakes	$6,831	Published	Complete
SPR 823	Constructability and Durability of Concrete Pavements	$24,377	Published	Complete
TPF 5 (371)	Capacity Adjustment Factors for Connected and Automated Vehicles in the Highway Capacity	$56,802	Published	Complete
SPR 832	Expanding the Oregon Motor Carrier Safety Action Plan: Best Return on Investment	$31,680	Published	Complete

Table 4.3: Expenditures and Status for Ongoing Major Projects FY 2022

Project No.	Project Title	Spent in FY'2022	Expected End Date	Status
	Continuing Projects			
719	Climate Change Impact on Coastal River Estuaries in Oregon	$50,962	7/31/2022	Published in FY2023
807	Coastal Landslide and Bluff Retreat Monitoring for Climate Change Adaptation	$108,811	9/29/2024	Continuing
812	Modeling Chloride Accumulation in Streams from Winter Road Salt Application for Federal…	$11,614	9/29/2022	Continuing
820	Development of Reliable Geotechnical Standards in Diatomaceous Silt	$87,836	6/30/2023	Continuing
824	Cascadia Ground Motion Estimates in Comparison to ODOT Design Criteria	$63,835	4/1/2023	Pre-Publication
829	Rumble strip design analysis and the durability of inlaid stripEs	$59,014	6/30//2022	Published in FY2023
830	Exploring Seismic Soil-Pile-Superstructure Interaction	$155,018	12/30/2023	Continuing
831	Leveraging Numerical Modeling for Development of Design Criteria for Gabion Rockfall…	$30,035	9/29/2022	Pre-Publication
833	Impacts of Intersection Treatments and Traffic Characteristics on Bicyclist Safety	$32,697	5/30/2022	Published in FY2023
834	Enhancing Design and Maintenance of Horizontal Landslide Drain…	$76,821	11/29/2023	Continuing
835	Implementation of a Laboratory Conditioning and Testing Protocol… Asphalt Mixtures	$101,088	4/30/2022	Pre-Publication
836	Prioritizing Wildlife Collision Mitigation Zones for Long Range Planning Efforts	$67,630	8/29/2023	Continuing
837	Automated Detection of Traffic Sensor Malfunctions	$71,966	9/15/2023	Published in FY2023
838	Center Line Rumble Strip Effects on Pavement Performance	$127,520	4/30/2023	Pre-Publication
839	Work Zone Safety During Traffic Control Setup, Removal, and Changes	$110,941	4/1/2023	Continuing
840	Safest Placement for Crosswalks at Intersections	$119,155	1/29/2023	Continuing
841	Pedestrian Equity Analysis	$14,782	12/20/2022	Continuing
842	Constructing High-Density Longitudinal Joints to Improve Pavement Longevity	$108,663	6/29/2023	Continuing
843	Vulnerability and Risk Prioritization for Coastal Highway Erosion Areas of Concern	$132,208	2/29/2024	Continuing
844	Evaluation of Curb Ramp Compliance	$125,083	7/31/2023	Continuing
845	Optimizing Maintenance Priorities for Driving Safety	$22,409	7/31/2023	Continuing
847	Alternative Bridge Deck Overlays	$101,524	7/31/2023	Pre-Publication
848	Trucking Platooning Impact on Bridge Loading – Policy and Regulatory Implications	$220,333	7/31/2022	Started

849	Improved Systematic Analysis to Predict Roadway Safety Performance	$116,305	3/3/2024	Started
850	Automating LIDAR Data to Develop and Manage Active Transportation Asset Inventories	$73,069	06/31/2024	Work Started
851	Evaluation of Electronic Enforcement of Motor Carrier Compliance and Safety	$45,782	06/31/2024	Work Started
852	Implementation of Balanced Mix Design Methods in Oregon to Meet Long-Term Performance Goals	$64,485	06/31/2025	Work Started
853	Predicting Near Real-Time Post-Fire Landslide Debris Flows Along ODOT Corridors	$84,704	06/31/2025	Work Started
854	Validation of the New Speed Zoning Method in Terms of Speed Compliance and Safety Outcomes	$40,617	06/31/2024	Work Started
855	Removing Residual Lane Markings to Reduce Driver Confusion	$67,665	06/31/2024	Work Started
856	Automated Methods for Correcting ODOT's Real-Time GNSS Network for Surveying and Post Disaster Recovery	$61,543	4/30/2025	Work Started
857	Active Transportation Counts from Existing On-Street Signal and Detection Infrastructure	$23,077	8/31/2024	Work Started
858	Development of Procedures and Technologies for Chip Seal Construction Quality Control in Oregon	$72,471	06/31/2024	Work Started
859	Real-Time Continuous Bridge Scour Monitoring for Improved Safety and Cost Savings	$31,700		Work Started
860	Piloting Smart Work Zone Technologies to Improve Oregon Highway Safety and Mobility	$80,686	06/31/2024	Work Started

Table 4.4: Other FY 2022 Research Activities

Project #	Project Title	Spent FY 2022	Status
301-000	SPR Project Selection and Development	$353,677.75	Ongoing
302-000	SPR Implementation	$53,043.17	Ongoing
304-401	Northwest Transportation Conference	$0	Ongoing
304-481	AASHTO Technology Implementation Group	17081.53	Ongoing
304-121	National Research Liaison and NCHRP Activity	$545	Ongoing
304-821	GNSS Surveying methods	$0	Continuing
304-841	Fish Presence	$38,093	Continuing
304-851	Test Hydraulic Design	$5,792	Continuing
304-861	NITC(UTC) Support	$0	Complete
304-871	NITC(UTC) VE BIKE	$734	Complete
304-881	Auto Sig PM Timings	$1,264	Complete
304-881	Steep Slope Brohmann	$23,787	Continuing
304-911	Shear Responses of Soils using CPT Based Methods	$29,259	Continuing
304-921	Improved Erosion Control Performance	$0	Continuing
304-931	Real-Time Scour Monitoring	$21,500	Continuing
500-040	State Information Requests (State funded)	$82,057.66	Ongoing

4.2 BUDGET AND FUNDING

Research funding originates from several sources:

Federal State Planning and Research (SPR)

SPR program funding is set at two percent of each state's FHWA highway funding under 23 U.S.C. 307(c). Of that two percent, at least 25 percent (i.e., 0.5%) is specifically identified for Research, Development, and Technology Transfer (RD&T). For Oregon, in recent years this amounts to roughly $2.2 million per year. SPR RD&T funds support a large share of direct expenditures on research projects. In addition to those funds specifically earmarked for research, in recent years the Research Section also has drawn research project and T2 program funds from the planning portion of SPR.

Local Technical Assistance Program (LTAP)

FHWA LTAP funding is targeted for technical assistance and training for local agency public works programs. These funds provide half the funding for the programs and activities of the T2 program.

Oregon Highway Fund

These funds are used in several ways. The Research Section uses state highway funds to cover indirect costs. In addition, with some specific exceptions, SPR funds require 20% local participation. In most cases, the source of these “matching” funds is the Oregon Highway Fund. Finally, a few research projects are carried out entirely with state highway funds.

Local Government

LTAP funding requires 50 percent local participation. Most of these required matching funds are provided by the Association of Oregon Counties and the League of Oregon Cities. Members of these organizations are the primary recipients of T2 services.

Table 4.5 summarizes expenditures by program area and by source of funds.

Table 4.5: Expenditures Summary by Program and by Source of Funds

	Federal			Oregon		
Program	**SPR Research**	**LTAP**	**Other Federal**	**State Funds**	**Local Government**	**Total**
SPR Research Program	$2,797,831			$699,458		$3,497,288
State Research Program				$82,812		$82,812
LTAP Program		$152,535		$76,268	$76,268	$305,071
TRB Subscription	$34,585					$34,585
NCHRP	$511,699					$511,699
OR Led Pooled Fund	$73,609					$73,609
External Pooled Fund						$0
Research & Library Indirect				$595,782		$595,782
LTAP Indirect		$50,216				$50,216
Other			$14,256.40	$3,564		$17,821
TOTAL	**$3,417,724**	**$202,751**	**$14,256**	**$1,457,884**	**$76,268**	**$5,168,884**

5.0 OTHER 2022 RESEARCH ACTIVITIES

In addition to major research projects, the ODOT Research Section is responsible for a number of ongoing programs and activities, smaller projects, and the annual selection of new research projects.

These include:

- the Oregon Technology Transfer (T2) Center, Oregon’s Local Technical Assistance Program (LTAP);
- research project selection;
- small, discretionary projects;
- specific activities to support research implementation;
- selection of and participation in pooled fund projects with other states; and
- serving as ODOT’s point of contact for regional and national transportation research activities.

The next few pages present activities and accomplishments in some of these areas.

5.1 OREGON TECHNOLOGY TRANSFER CENTER (T2)

The T2 Center provides transportation-related information to local agencies throughout Oregon. The Center is jointly funded by FHWA, local agencies, and ODOT. Oregon’s T2 Center is one of 53 centers in the nation that make up FHWA's Local Technical Assistance Program (LTAP) and Tribal Technical Assistance Program (TTAP).

The T2 Center provides the following services:

- a lending library of audio/visual materials;
- a program of free and low cost seminars, training classes, and workshops;
- a “Circuit Rider” service that includes annual technical assistance and informational visits to local road agency customers;
- responses to customer inquiries relating to transportation technology;
- a newsletter on transportation-related topics of general interest.

The T2 Center strives to make local road agencies aware of the latest and most effective transportation technologies. T2 does this by acting as an information and training resource to encourage and strengthen communication between government agencies at all levels and through the delivery of “low cost seminars, training classes and workshops” to local road agency employees.

The center’s training program is its most visible service. It consists of three elements: 1) short courses, which are delivered by Circuit Riders and focus on roadway and workplace safety; 2) a training program, which delivers six or more events per year in partnership with organizations such as the Oregon Chapter of the American Public Works Association (APWA); and 3) a two-level Roads Scholar certification program with 18 core classes taught by in-house and contract trainers. The Roads Scholar program is the most formalized aspect of the center’s training services and continues to be very successful.

5.2 RESEARCH PROJECT SELECTION

Project selection begins in the fall with modifications and updates to published research priorities. (Priorities for Fiscal Year 2022 are posted online at: https://www.oregon.gov/odot/programs/pages/research.aspx#step8). The process ends in the spring with the annual project selection meeting.

Research project selection is carried out in two stages. Expert Task Groups (ETGs), with support and coordination from the Research Section staff, make initial recommendations. The ODOT Research Advisory Committee (RAC) makes the final decision, selecting projects to go forward from the pool of ideas nominated by the ETGs.

A list of the new research projects selected for FY 2022 is shown in Table 5.1: New Projects Selected for Fiscal Year . Figure 5.1: ODOT research project selection timetable, provides a schematic of the project selection timetable.

5.3 SMALL, QUICK RESPONSE, AND DISCRETIONARY PROJECTS

Small Projects

Each year the Research Section conducts small projects, typically totaling $50,000 or less each. Funds are set aside for these types of projects so that money may be quickly allocated once a proposal is approved. These quick response or discretionary projects may be funded using SPR funds or using state funds entirely.

Information Requests

Divisions, sections, and units of ODOT will periodically request information from the Research Section. Information requests typically consist of requests for literature searches, statistical analyses, or small compilation reports. The section also responds to requests from other states about ODOT practices. On occasion, local transportation agencies have requested information, as well.

Though information requests are not tracked individually, it is estimated that the research staff spent 1820 hours responding to requests in Fiscal Year 2022, addressing a wide range of topics.

Table 5.1: New Projects Selected for Fiscal Year 2022

Project No.	Project Title	Scheduled End Date	Total Project Budget
861	Signal-Controller-in-the-Loop Simulation for Testing and Deploying Advanced Signal Operations on Arterial Roadways	6/2025	$237,295
862	Increasing Asphalt Recycling to Reduce Paving Costs, Improve Pavement Longevity, and Reduce Environmental Impact	11/2025	$351,720
863	Effects of Trucking Regulatory Relaxations on Freight Safety in Oregon	12/2024	$207,500
864	Phase 2: Quantitative Evaluation Process for Improved Rockslope Safety and Reduced Maintenance	6/2026	$395,300
865	Low-Carbon Ultra-High Performance Concrete for Use in Highway Infrastructure	9/2025	$408,000
866	Prototyping Automated Framework for Asset Extraction and Characterization from Mobile Lidar Data	6/2025	$315,000
867	Automated Wildlife Detection for Wildlife Vehicle Collision Reduction	6/2027	$480,100
868	Develop a new VisionEval Land Use Model for Strategic Evaluation of Land Use Scenarios	6/2025	$230,000
869	Safety and User Perceptions of Auxiliary Bike Lanes	6/2024	$59,100
870	Placement Options for In-street Pedestrian Crossing Signs (R1-6a)	6/2026	$212,751
871	Validation of HSM Crash Prediction Methods for Specific Intersection Types in Oregon	6/2025	$185,600

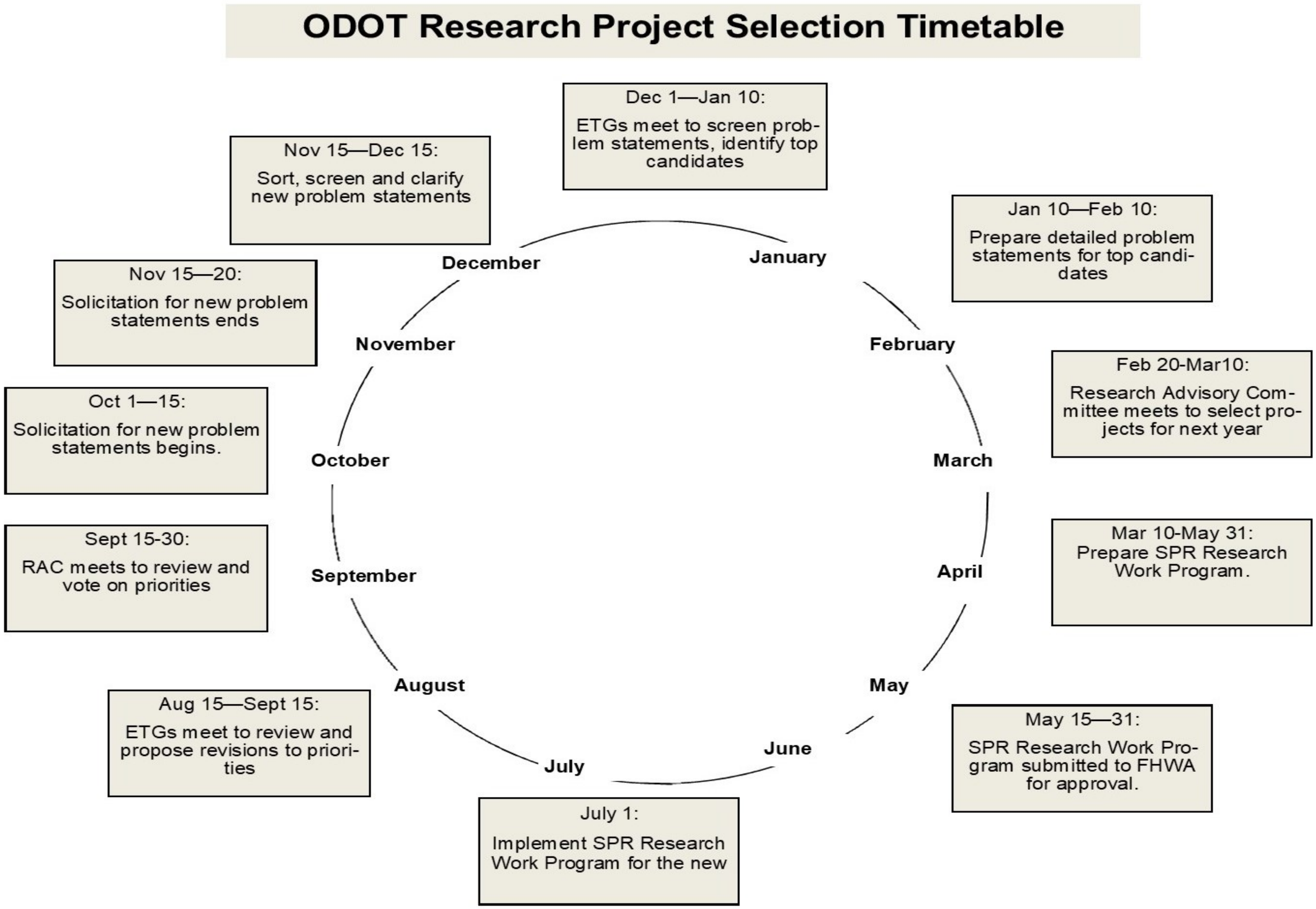

Figure 5.1: ODOT research project selection timetable

5.4 POOLED FUND PROJECTS

The Research Section has committed to working with other states to fund research through the Transportation Pooled Fund (TPF) program. This program offers significant advantages.

One advantage is cost sharing. For every ODOT dollar invested in these pooled fund projects, about $15 is leveraged from other organizations. A second advantage is that TPF projects are approved for 100% federal funding, which means participating states do not need to use state matching funds. In Fiscal Year 2022, ODOT led three and contributed to eight pooled fund projects (Table 5.2). Oregon commits a mix of SPR and state funds to these projects. ODOT Research continues to monitor fourteen ongoing-pooled fund projects from previous years.

Table 5.2: Transportation Pooled Fund Project Summary

Number:	Title:	Lead Agency	Fund Source	ODOT FY 22	Total Project ODOT
TPF-5(178)	Implementation of the Asphalt Mixture Performance Tester (AMPT) for Superpave Validation	FHWA	SPR B		$105,000
TPF-5(241)	Western States Rural Transportation Consortium (WSRTC)	Washington State	State		$10,000
TPF-5(255)	Highway Safety Manual Implementation	FHWA	State		$80,000
TPF-5(260)	Next-Generation Transportation Construction Management (TCM)	Colorado	State		$25,000
TPF-5(264)	Passive Force-Displacement Relationships for Skewed Abutments	Utah	SPR B		$30,000
TPF-5(283)	The Influence of Vehicular Live Loads on Bridge Performance	FHWA	SPR B		$50,000
TPF-5(288)	Western Road Usage Charging Consortium	Oregon	State		$175,000
TPF-5(299)	Improving the Quality of Pavement Surface Distress and Transverse Profile Data Collection and Analysis	FHWA	SPR B		$90,000
TPF-5(301)	Support Services for Peer Exchanges	Oregon	SPR B		$ -
TPF-5(316)	Traffic Control Device (TCD) Consortium	FHWA	State		$60,000
TPF-5(343)	Roadside Safety for MASH	Washington State	State		$300,000
TPF-5(349)	Western Alliance for Quality Transportation Construction (WAQTC)	Utah	State		$75,000
TPF-5(350)	Development of NGL Database for Liquefaction-Induced Lateral Spread	Utah	State		$20,000
TPF-5(353)	Clear Roads Phase II	Minnesota	SPR B		$125,000
TPF-5(355)	Stormwater Testing and Maintainability Center	Oregon	State		$ -
TPF-5(357)	Connecting the DOTs: Implementing ShakeCast Across Multiple State Departments of Transportation for Rapid Post-Earthquake Response	Caltrans	State	$15,000	$105,000
TPF-5(358)	Wildlife Vehicle Collision Reduction and Habitat Connectivity	Nevada	SPR B		$100,000

Number:	Title:	Lead Agency	Fund Source	ODOT FY 22	Total Project ODOT
TPF-5(367)	Evaluation and Full Scale Testing of Concrete Prefabricated Bridge Rails	Iowa	State		$60,000
TPF-5(369)	Collaborative Development of New Strategic Planning Models	FHWA	SPR A		$125,000
TPF-5(371)	Developing "Highway Capacity Manual" Capacity Adjustments for Agency Connected and Autonomous Vehicle Operational Planning Readiness under Varying Levels of Volume and Market Penetration	Oregon	SPR B	$43,930	$93,930
TPF-5(384)	Nontraditional Methods Vehicle Volume	FHWA	SPR B		$10,000
TPF-5(386)	Gravel-Bed River Assessment Tool for Improved Resiliency of Engineering Design	Washington State	SPR B		$15,000
TPF-5(398)	Moving Forward with the Next Generation Travel Behavior Data Collection and Processing	FHWA	SPR A	$25,000	$85,000
TPF-5(399)	Improving the Quality of Pavement Surface Distress and Transverse Profile Data Collection and Analysis Phase II	FHWA	SPR B	$15,000	$75,000
TPF-5(433)	Behavior of Reinforced and Unreinforced Lightweight Cellular Concrete for Retaining Walls	Utah	SPR B		$40,000
TPF-5(437)	Technology Transfer Concrete Consortium (FY20-FY24)	Iowa	State	$8,000	$40,000
TPF-5(440)	Support for Urban Mobility Analyses	Texas	SPR A		$50,000
TPF-5(442)	Transportation Research and Connectivity	Oklahoma	SPR B		$50,000
TPF-5(447)	Traffic Control Device (TCD) Consortium (3)	FHWA	State	$15,000	$30,000
TPF-5(451)	RUC West	Oregon	State		$50,000
TPF-5(456)	EconWorks - Improved Economic Insight	Arkansas	SPR A	$4,000	$20,000
TPF 5(470)	Traffic Signal Change and Clearance Interval Pooled Fund Study	FHWA	SPR A		$30,000
TPF-5(479)	Clear Roads Winter Highway Operations Phase III Pooled Fund	Minnesota	SPR B	$25,000	$125,000

5.5 REGIONAL AND NATIONAL RESEARCH PROGRAM COORDINATION

ODOT participates directly or indirectly in a number of national research programs and initiatives. In general, the role of ODOT Research is that of liaison, or point of contact. Among the responsibilities carried out by ODOT Research in Fiscal Year 2022 are the following:

Transportation Research Board

The Research Section Manager is the Oregon DOT representative to the Transportation Research Board (TRB). This responsibility involves a range of duties that relate to coordination of communication and services between ODOT and TRB.

AASHTO Research Advisory Committee (RAC)

The Research Section Manager is also a member of the AASHTO Research Advisory Committee (RAC). The RAC has several important functions within AASHTO and in setting the national transportation research agenda, as well as serving as the principal point of contact for transportation research between states.

The RAC meets annually. In addition, RAC members meet regionally via bi-monthly conference calls. Specific functions and duties of the Research Advisory Committee include the following.

- **Review and rating of projects submitted to the National Cooperative Highway Research Program (NCHRP)** Every year; problem statements are submitted to NCHRP for funding. The TRB, on behalf of AASHTO and the state Departments of Transportation, allocates approximately $37 million each year for research benefiting highways. The AASHTO RAC member in each state is responsible for submitting an advisory ballot, used to select projects for funding.

- **Nomination of NCHRP project panel members** Each NCHRP project is managed by a panel of experts. Many of those panelists are drawn primarily from the 50 state Departments of Transportation. AASHTO RAC members are responsible for nominating panel members from their respective states.

- **Coordination of synthesis data collection** One component of NCHRP is a sub-program called NCHRP Synthesis, which consists of small studies of the state of knowledge and current practice in a particular area of highway technology. Each synthesis project includes a questionnaire survey of current practice by state Departments of Transportation. The AASHTO RAC members are responsible for coordinating that data collection within their own departments.

- **Other support for NCHRP** RAC members pay their state's annual NCHRP contribution, provide assistance to DOT employees who wish to submit problem statements, and disseminate NCHRP research results within their departments.

- **National RAC listserv** Members of the Committee are members of an electronic mail listserv, which is used to communicate on a variety of topics. A key use that has evolved is the gathering of information about practices in other states, particularly with regard to the applications of new technology. ODOT Research coordinates hundreds of such requests for information from other states every year.

University Transportation Centers

In addition to providing full project funding, ODOT Research Section funds are also used to leverage funds contributed by other organizations and centers to jointly sponsor research projects. University Transportation Centers (UTCs), including the Portland State University led Transportation Research and Education Consortium (TREC), Pacific Northwest Transportation Consortium (PacTrans) in which Oregon State University is a full member, and Western Transportation Institute have been important partners in funding research.

Title VI of the Civil Rights Act

The Oregon Department of Transportation ensures compliance with Title VI of the Civil Rights Act of 1964; 49 CFR, part 21; related statutes and regulations to the end that no person shall be excluded from participation in or be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance from the U.S. Department of Transportation on the grounds of race, color, sex, or national origin.