Request for Proposals for UCI Research Projects
USDOT
Pacific Southwest Region
University Transportation Center

RFP Issued: February 1st, 2021

Proposals Due: February 28, 2021

Anticipated project start date: Fall 2021

Maximum project duration: up to 12 months

ITS·IRVINE
INSTITUTE of TRANSPORTATION STUDIES

Table of Contents

Introduction

The USDOT Pacific Southwest Region University Transportation Center (PSR) is the Regional UTC for US Region 9 (California, Arizona, Nevada, Hawaii, and the Pacific Islands). PSR is led by the Metrans Transportation Center, University of Southern California and includes the following partners: California State University, Long Beach, Northern Arizona University, Pima Community College, University of California, Davis, University of California, Irvine (UCI), University of California, Los Angeles, and University of Hawaii. PSR funded research is expected to result in scholarly publications and contribute to generating larger grants from other sources.

Funding for this RFP

Funding for this RFP is being provided by Caltrans Division of Research, Innovation and System Information. Caltrans has requested that PSR RFPs for all partner universities be synchronized this year in an effort to streamline the review and selection process. Total faculty research funding available to ITS-Irvine under this RFP is expected to be up to approximately $200,000 but is not guaranteed. Caltrans funds are available only for PSR partner universities in California. *These funds have not yet been formally committed for potential UCI projects by Caltrans, nor have any other matching funds.* Thus, project awards will depend on both the availability of funding and the timing of project selections by Caltrans. While GSR appointments on successful project proposals may allow for a summer start date, past experience suggests that a later start date is quite possible so PIs should plan accordingly.

Given the anticipated competition for these funds, prospective applicants should carefully consider their expertise relative to the thematic areas and topics along with their ability to obtain Caltrans support as described below in the section Selection Criteria for all Proposals.

The remainder of this RFP describes eligibility requirements, research topics, selection criteria, funding guidelines and restrictions, project requirements, and proposal instructions as well as budget instructions and sample budget sheets. Submission instructions and a cover page are also provided.

Eligibility

Full-time ITS-Irvine Faculty Associates who are tenure track faculty, or ITS-Irvine Research Staff eligible to serve as Principal Investigators at UCI, are eligible to serve as Principal Investigators on PSR UTC grants. Proposals may include multiple investigators. Proposals may also include research faculty and non-tenure track faculty from the PSR partner universities as Co-Principal Investigators.

Caltrans Research Priorities

As the source of funds for this RFP is Caltrans, priority will be given to projects that help to implement and/or inform future activities associated with Caltrans priority research areas. Caltrans is seeking proposals on 28 specific research needs statements, which can be found in Appendix A - Caltrans Research Needs for FY 2021-22. To learn more about the Caltrans Division of Research, Innovation and System Information's ongoing goals, see Appendix B – Caltrans DRISI Research Goals.

If you have an applied or basic research idea that does not address a priority topic in Appendix A, but you think that a specific individual or department at Caltrans would have interest in based on previous contacts or knowledge of ongoing work, you are encouraged to apply. In this case (that a proposal does not address a specific research need outlined in Appendix A), the applicant must provide a short explanation in their proposal identifying whether or not they are currently working with Caltrans staff on the proposed work and, if so, must indicate the specific names, divisions, and email address(es) of those contacts. This will ensure that proposals not addressing a pre-specified Caltrans priority are routed to relevant Caltrans personnel.

Selection Criteria for All Proposals

The selection and submission of proposals to Caltrans for possible funding will follow procedures established by the PSR UTC Executive Committee and Caltrans. Proposals will first be evaluated by the ITS-Irvine Director for relevance to the PSR UTC research program themes as well as Caltrans priorities. Proposals are expected to be selected on the basis of their evaluations along with programmatic priorities. Proposals will compete both within topics and across topics. PSR does not guarantee that proposals will be funded in all topic areas, or that any proposal will be funded.

It is expected that both peer and Caltrans reviewers will evaluate proposals according to the following selection criteria:

1. Demonstrated relevance to the above research program themes (a requirement) and to Caltrans strategic goals
2. Quality and research significance
3. Student involvement
4. Reasonableness of budget and cost-effectiveness
5. Qualifications to perform work and likelihood of successful completion
6. Match funding, if any, and potential for attracting larger grant funding
7. Prior performance on grants (as applicable)

Proposals that involve collaboration between partner universities, interdisciplinary proposals that cross school boundaries as well as participation from outside organizations are encouraged.

Proposers are encouraged to communicate with members of the PSR Executive Committee or other outside organizations in the development of research proposals. A list of Executive Committee members can be found in the directory page of PSR at https://www.metrans.org/PSR_UTC_key_personnel.

Commitments of participation (for example data sharing or match funding) from outside of PSR will be a consideration in making awards. *Any project that involves data collection, access to facilities, or cooperation of a private or public entity **must** include a letter of participation from the entity in the proposal. Without such verification of participation, the proposal will not be considered for funding.*

Proposers are encouraged to include undergraduate students in the research project if appropriate.

There are potential funding opportunities through various university programs that could support students working on PSR projects. Proposers are strongly encouraged but not required by this RFP to explore such opportunities with their schools and the campus.

Match Funding

The USDOT University Transportation Center program requires a non-federal match as a condition of the federal funds. Caltrans provides only a portion of the required match. Thus PSR encourages proposals that include match funding from non-federal sources. Proposals that include at least a 10% hard match (e.g. contribution to direct costs from external source) will receive priority consideration. For additional information, contact ITS-Irvine Assistant Director for Research Coordination Craig Rindt <crindt+psr2021@uci.edu>.

Project Selection

The PSR Executive Committee will make project recommendations to Caltrans, taking into account reviewer evaluations, programmatic priorities, prior project performance, and partner recommendations. Caltrans will conduct additional reviews of these recommended projects and approve selected projects for funding. Executive Committee members are allowed to submit proposals, but are not allowed to be present during deliberations and voting related to their proposals.

Funding Guidelines and Restrictions

Budgets should be conservative and cost-effective. Funding should be directed at new and original work. In some cases, PSR and Caltrans will consider continuations of prior PSR Caltrans match projects that have achieved significant results and have a high potential for deployment, scholarly products or large grants. PIs may submit multiple proposals, though it is unlikely that any PI will be awarded more than one grant. PIs with current PSR grants are eligible to apply. However, grants will not be awarded to PIs with outstanding deliverables (draft or final report; research brief; data management plan compliance) on prior PSR grants.

Budgets for research project proposals may include salary and benefits for one tenured faculty for one month, one assistant professor for two months, or one professional researcher (postdoc, project scientist, etc) for up to four months. Teams of investigators may receive pro-rated shares of these salary levels (e.g., 0.5 months for tenured faculty with two months for researcher). Research project proposals should include funding for one graduate student researcher (for 49% time during academic quarters, preferably for 3 quarters, and for 100% during summer, though shorter appointments may be allowed). Caltrans funds cannot be used for non-resident student tuition. Inclusion of funding for undergraduate student assistants is encouraged, but not required. Note that inclusion of funding support for students is taken into consideration in the review and evaluation of proposals. Professional researchers such as postdocs are not considered students for this evaluation criterion.

A written justification for all supplies and travel is required. An amount not to exceed $4,999 may be

included for office supplies, travel, and clerical support necessary for the conduct of the research and presentation of research findings at one academic or professional meeting (preferably in California). If more than $4,999 is requested, the applicant must provide a thorough explanation, and all costs must be itemized. Allowed additional expenses include the following: costs of travel for data collection, costs of leasing special equipment or purchasing data not otherwise available, and costs of printing, processing, and mailing questionnaires. Permanent equipment is not allowable. International travel is not allowable. Travel to any Transportation Research Board meetings or events is not allowable on Caltrans funds. Consultant services are not allowed, and Business Service Contracts should be avoided on Caltrans funds.

UCI PSR funded proposals will have accounts administered by ITS-Irvine. At partner universities, accounts will be set up within the subcontract per each partner's policies.

Funding Guidelines:

1. Research project awards should have a maximum of approximately $75,000 per year (including indirect costs of 20%)
2. The typical project duration is one year
3. **Note that conservative and cost-effective budgets are strongly encouraged.** PSR reserves the right to reduce the budgets of submitted proposals. Projects should be budgeted to begin in the fall quarter 2021, though the exact start date may vary.

Project Requirements:

All research projects have the following requirements for PSR.

1. Semi-annual progress reports conforming to PSR guidelines
2. A Draft Final Report, conforming to PSR guidelines, which must be delivered 30 days prior to the completion date of the project. The Draft Final Report is subject to peer review. The Draft Final Report should include an executive summary, data management plan compliance explanation, and documentation of the research project. It should be complete, original, well organized and accurate; and comply with report content and format guidelines (posted to the PSR website)
3. A Final Report that complies with the review comments and requirements must be delivered within 30 days after the review of the Draft Report. Draft Final and Final Reports are distributed via the PSR websites, and are submitted to PSR sponsors and to various publications databases
4. A separate statement listing publications, presentations and inventions resulting from research; names of students supported along with their degree status; and a summary of project results. This statement is to be submitted with the Draft Final Report

5. A 2- to 4-page Research Brief suitable for a general audience that summarizes the main findings of the research and its contribution to practice or policy. This brief is to be submitted with the Final Report
6. A brief Biographical Sketch for each of the project's investigators to be submitted with the Draft Final Report. A template for the biographical sketch will be provided with the notification of award. At least one presentation of the funded project's research at a thematic conference or seminar organized by PSR
7. Timely reporting of all information requested for the PSR Annual Report
8. Copies of all papers submitted to journals or conferences that are based on the project's research. Copies should be provided to the PSR Administrator
9. Acknowledgement of PSR support in all work that results from PSR funding, including peer-reviewed publications and conference presentations
10. **Conformance to new data management requirements imposed by DOT.** More information is available here: https://www.metrans.org/assets/upload/PSR_DMP.pdf
11. **PI ORCID number.** PIs are directed to obtain and provide this number to the center administrator within 30-days of notification of project selection. Numbers can be obtained at https://orcid.org/register

Projects funded by Caltrans will have additional reporting and budget requirements. Principal Investigators of proposals selected for Caltrans funding will be informed of these requirements during contract execution.

Proposal Instructions

Research Proposal Instructions

Research proposals should be succinct and clearly written for a mixed technical and non-technical audience. Each proposal must include the following sections:

1. Project title and basic info (See sample template in Appendix D)
2. Project abstract
3. Description of proposed research, including project purpose, and relevance to PSR themes
4. Methodology and scope of work
5. Tasks, Schedule and Deliverables (steps that will be followed in executing the methodology, and when they will be completed)

6. Description of the expected research product and contribution to practice (e.g. peer-reviewed publication)
7. Description of how the PI will comply with the PSR Data Management Plan (DMP). The DMP is available at https://www.metrans.org/assets/upload/PSR_DMP.pdf.
8. Qualifications (the research team's relevant skills and experience that will help ensure success)
9. Budget justification (strong justification should be provided for unusual expenses, e.g., equipment). The extent of student involvement should be clearly stated
10. Reference list
11. Budget (1 page.) See template in Appendix D. Contact Craig Rindt <crindt+psr2021@uci.edu> for questions about creating a budget for PSR proposals. Budgets should assume a start date of 8/16/21.
12. Letters of participation, or match funding commitment (attached, any number and length) *Letters of participation are required for any project that involves data collection from private or public entities, access to private or public facilities, or cooperation of private or public entities.*
13. Short bios for all investigators and a list of recent (past 5 years or less) publications and funded research projects (2-page maximum)

Proposals are limited to no more than 8 pages in sections 3 – 7. **Submitters are strongly encouraged to use the standard PSR Proposal and Budget Templates to write their proposal**, which include the necessary formatting specified in Appendix D (append the second sheet of the budget template as item 11 for the requirements above). Both of these can be found in the online shared folder for this RFP. *Note that PIs of selected proposals will be asked to convert their proposal into a Caltrans-specific task order format prior to execution of the contract. Use of the standard templates will simplify this process.*

Proposals should demonstrate their responsiveness to PSR UTC selection criteria, according to the following guidelines:

Selection Criteria	**Most Relevant Section(s)**
Relevance to research theme areas	Background/Objective
Quality and research significance	Methodology/Tasks
Student involvement	Budget justifications
Reasonableness of budget and cost-effectiveness	Budget justification
Qualifications	Qualifications

Match funding & potential for other grant funding	Budget justification, Methodology/Tasks
Prior performance	Prior project accomplishments

Budget Instructions

For UCI: Please use the UCI Office of Research guidelines in preparing your budget. Tuition charges are not subject to F&A charges. The F&A cost rate for PSR Caltrans Match projects is 20%. Proposers should contact their home department financial analyst for budget assistance. Any budget questions related to PSR requirements should be directed to Craig Rindt <crindt@uci.edu>.

Submission Instructions

Proposals must be submitted via email to ITS Assistant Director for Research Coordination, Craig Rindt at crindt+psr2021@uci.edu **on or before 5:00pm PDT on February 28, 2021**.

NOTE to PIs: If more than one proposal is to be submitted, they must be submitted using separate emails. Proposals received later than the deadline will be rejected. **It is the responsibility of the PI to deliver the proposal by the deadline and to confirm receipt.**

Please note that all proposals must include a budget; proposals submitted without budgets will be determined to be incomplete and rejected.

PSR will reject proposals that: (1) are received after the deadline, (2) do not conform to eligibility requirements, (3) are incomplete, or (4) do not conform to thematic requirements.

Further Information

For further information, UCI PSR Associate Director Prof. Stephen Ritchie can be reached at srtichie@uci.edu . In addition, check https://www.metrans.org/psr-utc for center organization and links to outside agencies. For further information regarding program rules and procedures contact ITS Assistant Director for Research Coordination, Dr. Craig Rindt at (949) 824-1074 or crindt@uci.edu.

Appendices

- **Appendix A - Caltrans Research Needs for FY 2021-22**
- **Appendix B - Caltrans DRISI Research Goals**
- **Appendix C - PSR Research Themes**
- **Appendix D - Budget Information and Forms**

Appendix A - Caltrans Research Needs for FY 2021-22

Advancing transportation equity through transportation related tax credits for public participation

Research Need: Explore a transportation tax credit or other assistance for qualified low-income Californians to attend public meetings

Research Description: Is cost of transportation to public hearings or workshops a barrier for participation by disadvantaged communities? What level of incentive will increase attendance by low income households?

Potential for Implementation: Remove barriers to participation in transportation planning and decision-making within marginalized communities.

Assessing the role of Indian Reservation Roads in freight movement

Research Need: The Indian Reservation Roads (IRR) program, established in 1928, funds maintenance, construction, and improvement of IRR routes that do not receive state funding through federal-aid funding (CA IRR Tech Report). Currently, FHWA is assigned oversight of the Tribal Transportation Program (formerly the IRR program) and is responsible for determining available funding to allocate to the Bureau of Indian Affairs (BIA) for projects on the National Tribal Transportation Facility Inventory (NTTFI), formerly the IRR system (CA IRR Tech Report). Many of California's Tribal lands are accessed from or served directly by the State highway System, including routes identified within the State Highway Freight Network. Future study is needed to determine what role the NTTFI (formerly the IRR system) plays in the movement of freight to and from the Tribal lands of California.

Research Description: The objective of the proposed study would be to analyze California's NTTFI designated roads to identify which Tribal Transportation Program (TTP) routes (or portions of routes) are already on California State Freight Highway Network, to collect goods movement data on the IRR system, and to determine how the NTTFI system supports freight movement within the California as a whole.

Assessment of California climate change resiliency strategies

Research Need: Explore the deployment of resiliency strategies in the state's most vulnerable communities.

Research Description: Explore implementation of climate change policies that reduce GHG from transportation operations and projects. Explore impact of investments for climate resilient transportation infrastructure.

Potential for Implementation: *Expansion of District Climate Change Vulnerability Assessments*

Commodity flow survey for pass-through cargo

Research Need: *More information is needed on the composition and volume of pass-through freight traffic, that with both an origin and destination outside of California, in order to better understand the related costs and benefits.*

Research Description: *Analysis of commodity flows to more accurately assess multimodal freight related travel with both an origin and destination outside of California. Also, the study may include an economic analysis of these freight movements, including environmental effects.*

Digitizing corridor airspace for Advanced Air Mobility

Research Need: The vision behind Advanced Air Mobility (AAM) is for a safe and efficient aviation transportation system that will use highly automated, low noise, and low polluting/zero emission aircraft to transport passengers or cargo at lower altitudes within urban, suburban, or rural environments. This form of transportation will impact the airspace, existing transportation modes and networks, and underlying communities. Caltrans should initiate planning activities and research to better understand, anticipate, and plan for AAM integration as a new mode of transportation.

Research Description: Prepare a digital airspace corridor project that involves 3D digitization along a key transportation corridor and an existing airport airspace. Research will include:

- Identifying the proper software tools that can be employed for airspace digitization. Partner with software provider or airspace digitization provider as needed.
- Leveraging existing AAM literature, feasibility studies, and white papers
- Developing the airspace model over a selected geographical region
- Testing the model with AAM simulations
- Evaluating impacts including transportation corridor, airspace, and surrounding community
- Documenting findings and developing lessons learned

Potential for Implementation: Once this model and study is completed it can serve to inform Caltrans and local agency planners on the issues, challenges, and opportunities around AAM deployment in California regions.

Early consideration of tribal heritage sites and cultural landscapes in long range transportation planning

Research Need: During environmental review and project delivery phases of Caltrans projects, Native American tribes continue to express concerns regarding the effects of transportation and land use developments on tribal heritage sites and landscapes. Tribes indicate a desire for such heritage resources to remain intact/undisturbed, and the preservation of 'sense of place' is a key concern. The ability to avoid and minimize impacts to tribal cultural heritage resources at a large scale is limited during project delivery phases by the fact that state and federal historic preservation laws are not triggered until there is a programmed/funded project. These laws require the identification and treatment of tribal cultural resources in consultation with tribes, but lack of appropriate planning leads to disjointed preservation efforts and project delays.

Since transportation planning, land use, and environmental considerations all intersect, the ability to engage with tribes about heritage resources and landscapes during earlier project phases would help inform larger local and regional efforts to promote the preservation of tribal heritage places.

In addition, the tribal values that call for the preservation of cultural heritage sites and landscapes are compatible with many of the State of California's goals around land conservation and climate resilience. Early engagement with tribes as part of long-range planning provides opportunities for mutually beneficial partnerships and more effective preservation of tribal cultural heritage in the state.

Research Description: FHWA's Planning Environmental Linkages Initiative provides a framework for early stakeholder engagement to promote the protection of environmental resources; however, the application of these concepts specifically to early engagement with tribes around tribal historic preservation issues is not in broad practice. More information is needed on how best to operationalize these planning and coordination principles with Tribes to achieve the intended goals.

Caltrans requests research focused on identifying potential best practices for early engagement with tribes on cultural resource issues, as well as any limitations. This may be accomplished through interviews and case studies to help inform the Department's policies and programs and to help advance multi-benefit, cross-sector, cross-jurisdictional landscape scale collaborations for land use and resource stewardship (this white paper addresses landscape level collaboration in CA and would be helpful in this research effort).

Potential for Implementation: Earlier engagement with tribes about cultural heritage preservation concerns prior to project delivery scenarios, ultimately reduces conflicts during project delivery (which minimizes costs, delays), improves historic preservation outcomes, and fosters better tribal government diplomatic relations. See more Planning Environment Linkage references and source information on the Caltrans NACS Branch webpage.

Economic and environmental impacts of expanded short line rail service

Research Need: To shippers, the ability to use short line railroads means lower transportation costs, more flexible local service options, and a greatly expanded market reach for local products through their Class I railroad partners. In order to promote smart investments in short line rail service, it is important to understand and quantify the potential benefits of short line rail versus the cost of expansion.

Research Description: A paper outlining the current state of knowledge around suitable markets for short line rail, potential for modal shift to rail, cost of expansion or other barriers to entry, and expected travel related effects of different short line expansion scenarios.

Environmental impact avoidance in freight corridors

Research Need: While California sees significant economic benefit (such as jobs, sales tax) by serving as the nation's global gateway, there is an associated cost exerted by the significant pass-through freight moving by truck and train. Research is needed to explore methods to reduce or eliminate negative externalities from freight movement, especially air quality effects.

Research Description: A white paper or small research project reviewing best practices or case studies around freight-related impact mitigation. Another potential product is a list of strategies with an assessment of their effectiveness in certain situations.

Equitably addressing issues arising from the use of State transportation facilities for shelter

Research Need: Caltrans faces the issue of equitably resolving safety, health, and operational issues that arise from people using the state right of way for shelter. What are the impacts of the presence of these individuals and what are the best ways for the State to fulfill sometimes competing responsibilities? What partnerships could facilitate improved efforts to meet the needs of California's homeless population?

Research Description: Caltrans seeks a study or white paper on best practices in resolving health, safety, operational, and other issues as a result of the unauthorized use of state owned land and facilities.

Expand remote access to jobs, goods, services, and education

Research Need: Outline how telework can reduce VMT and GHG. Refine the relationship between telework and VMT reductions, as there are conflicting thoughts on the effectiveness of telework as a GHG reducing tool. This can be further refined to define which strategies work together with telework to reduce GHG emissions.

Research Description: Study the implications of a variety of policies and incentives to reduce VMT and GHG through the promotion of telework. One particular area of inquiry may be whether or not the expansion of internet access can have VMT reducing effects.

Potential for Implementation:

- Incentive for telework policy expansion
- Support broadband deployment in projects
- Inclusion in CTP 2050 Implementation and future iterations of the CTP

Exploring Distributed Ledger Technology (DLT) for reducing friction in fare payments

Research Need: Existing options that California transit riders have in fare payments, such as cash, discounts, passes, etc., hinder efficient trip planning, especially for a multimodal trip. The non-standardized practice of accepting various fare payment options by transit agencies leads to confusion. It creates a negative perception of the State's transit systems, which ultimately impacts ridership.

Research shows that transit riders invest additional times in purchasing tickets if using cash, which adds to their existing waiting and riding times at transit stations. Payments through cash, which is popular among unbanked and rural residents, puts these groups of riders at a disadvantage – as these riders depend heavily on the use of transit for commuting. For multimodal riders from these groups, cash payments for boarding a new mode for transfer, the whole experience of riding the transit is discouraging.

Therefore, a standardized fare payment structure could be planned to address these issues to increase California's transit ridership. A significant effort could be using a single ticket purchase of a multimodal trip and consolidating various fare payment types into a single transaction.

Distributed Ledger Technology (DLT), which is synchronized management of transactions across various parties, has recently emerged as a success in cashless payments being managed by transit agencies worldwide. The technology allows keeping the transaction fee to the bare minimum, is interoperable and scalable, and provides a safe and reliable financial environment of record-keeping assisting the unbanked riders. Further success of the DLT in this process has been enhanced through smartphone applications, thereby encouraging contactless payments during the current pandemic periods of COVID-19. The

application further facilitates various travel planning needs and routes consisting of bookings, tickets, and payments for all the modes used in a multimodal trip.

However, the extent to which DLT could succeed in its application by California transit agencies is unknown. In this aspect, with a diverse network of transit agencies and systems, various modes, and fare payment structures and collection methods, California can serve as a perfect testbed to evaluate DLT in reducing friction in payments.

Research Description: The objectives of this research would be to identify challenges transit agencies and riders in California face with various fare payment structures and to explore the applicability of DLT in overcoming the identified challenges. Therefore, the research activity will involve the following: i) conducting literature reviews to document the application of DLT in public transportation systems, especially in the management of fare payments, ii) developing a questionnaire-based survey to gather inputs on using DLT from various transit agencies of California, iii) data collection using the survey execution, vi) data analysis and vi) recommending best practices for a successful implementation of DLT across the transit agencies of California.

Potential for Implementation: Recommendations will be made to overcome existing challenges in DLT implementation by various transit agencies in California, whether serving rural or urban riders. Further, transit service improvements primarily through reduced travel times, transaction fees and increased satisfaction levels of transit users can be assessed through DLT deployment as a pilot study.

Facility name assessment pilot for Caltrans District 4

Research Need: Caltrans is responsible for creating a safe, equitable and inclusive transportation system for all. As such, Caltrans must seek to understand its role in institutional inequity both historically and in the present. Named freeways, highways, structures and other appurtenances that are part of the California State Highway System may have equity, racial and representational justice issues associated with them; however, Caltrans currently lacks a comprehensive inventory of such facilities and a context for understanding issues of racism and equity that may be associated with them. In addition, a framework for identifying and addressing current concerns, issues and potential reasons why a facility may be associated with racism and negative equity issues does not exist. Finally, a decision-making protocol is needed to guide procedures surrounding the identification, documentation, and resolution of such equity issues within the California State Highway System. Such a protocol is needed to provide guidance regarding compliance and possible removal, renaming or other such actions for facilities which may have equity issues and for Caltrans to act in an equitable manner.

Research Description: Conduct a pilot project in District 4 that meets the following objectives with the goal of applying the results Statewide.

- Identify and inventory Caltrans facilities within District 4 that are potentially associated with issues of equity.
- Develop a context statement documenting the methodologies and possible reasons, which would cause the name of a State-owned facility within the Caltrans District 4 right-of-way to be considered racist or hold negative equity impacts for the public .
- Create a decision-making protocol identifying the appropriate path forward once a State-owned facility with potential equity issues has been identified, and to address the documentation,

compliance and possible renaming, removal or other action to resolve the equity issue associated with an identified facility.

Feasibility, and efficiency benefits, of dedicated truck lanes

Research Need: Separating freight from other traffic may reduce congestion and the chance of traffic incidents related to mixing commercial and non-commercial vehicles. What are factors that have led to successful truck only projects in the past, what are some current barriers in California, and what benefits could be expected from separating truck and non-truck facilities?

Research Description: Study looking at considerations in the planning of truck-only facilities, successful and unsuccessful cases of the past, and the creation of a methodology to accurately assess costs and benefits.

GTFS, wayfinding, and transit ridership

Research Need: The California Integrated Travel Program (Cal-ITP) has instituted the California Minimum General Transit Feed Specification (GTFS) Guidelines and GTFS-Real Time (GTFS-RT) guidelines. GTFS is a method of receiving information about transit routes and fares, among other information, for use in transit planning and management applications. GTFS-RT provides real-time information, such as vehicle location, for dynamic trip-planning and management services. As agencies are added to the system, it is vital to measure the benefits of being added to Google Maps, Transit et al on ridership, ease of use, and other aspects of transit ridership. Having this information will allow Cal-ITP and transit agencies to adjust their offerings to better serve transit riders. Both qualitative and quantitative approaches should be considered on the impact of being in and out of major app systems. The research need is to determine how "digital wayfinding" impacts ridership.

Research Description: The research will employ a mixture of qualitative and quantitative methods to document the state of digital wayfinding and develop a methodology to link to ridership, or lack thereof. The research will add a specific focus on real-time predictions. The researchers will focus on transit agencies within California and how they use digital wayfinding and linking that to ridership. Rural agencies with sparse schedules are critical in this research because they have the fewest resources.

Potential for Implementation: The researcher will deliver a research paper and code repository as a final product. This research paper will help guide Cal-ITP and other transit decision makers in guiding transit infrastructure and programs in California. The code repository will assist in this.

Improved tools for "state of good repair" project prioritization

Research Need: Improve statewide risk and deteriorating modeling and life-cycle costing tools to minimize long-run maintenance costs and more efficiently manage assets.

Research Description: Identify at-risk infrastructure and apply life cycle cost assessments to hypothetical improvements, taking into account the cost of inaction.

Potential for Implementation: Identify at-risk infrastructure; identify expenditure of maintenance costs.

Infrastructure technology to improve travel safety for vulnerable road users

Research Need: Research is needed on infrastructure design that enhances safety for vulnerable roadway users such as bicyclists, pedestrians, scooters, people with disabilities, and other users of non-auto modes of transportation.

Research Description: Investigate technology applications to improve critical infrastructure security monitoring and reduce potential threats.

Potential for Implementation: Explore impact of investments for improved security monitoring applications. Provide real-time data to transit agencies for technology applications. Standardize Caltrans district road-user data.

Innovative technology and practice to improve goods movement and infrastructure post-COVID-19

Research Need: Over the last decade, the increased prevalence of ecommerce and home deliveries, autonomous trucking and warehousing, and innovative clean freight technologies have evolved the freight landscape. Consistent with the CFMP and Sustainable Freight Action Plan, the CTP 2050 aims to leverage these innovations to move goods more effectively.

Research Description: Explore infrastructure and operational strategies to meet demand for deliveries post-COVID-19, including research into the benefits and tradeoffs of drone deliveries, bike delivery services, staging areas, loading zones, and pick-up centers.

Potential for Implementation: Knowledge of how to navigate through or subvert challenges posed to goods movement when under external logistical challenges may lead to new policies or programs.

Inventory of the effectiveness of transit, rail, and shared mobility improvements

Research Need: Many policies and programs exist to improve access to transit, rail, and shared mobility options. What is the relative effectiveness of policies directed toward increased adoption of these modes?

Research Description: Study the implications of a variety of policies and incentives to increase options for transit, rail, and shared mobility ridership, including:

- Economic and travel impacts of tax benefits and subsidies for transit commuters or other non-auto modes
- benefits and tradeoffs of universal fare-free transit
- Improved integration of travel, such as through the California Integrated Travel Program (Cal-ITP), which creates statewide standards for fare integration, trip planning, and data reporting
- Modernization of transit systems through ITS elements like signal priority, automatic passenger counters, and real-time traveler information systems (Transit Performance measurement, fare integration)

Managing the adoption of connected and autonomous vehicles in disadvantaged communities

Research Need: Investigate potential policies that expand CAV access to aging and youth populations, underserved communities, unbanked and low-income users, and users with disabilities.

Research Description: Certain communities may be underserved by public transportation, exposed to a lack of social distancing in public transit, or are reliant in some way due to lack of access. How would fleet CAVs affect travel behavior in disadvantaged communities? This study would involve an investigation into whether or not increased access to Connected Autonomous Vehicles can improve access to important destinations.

Potential for Implementation: Information can be useful in the deployment of statewide policy on the adoption of CAV fleets.

Methods to expand access to safe and convenient active transportation options

Research Need: Highlight areas in which access can be improved for active transportation. Explore new methods and regulations to encourage active transportation.

Research Description: Study the implications of a variety of policies and incentives to improve access to safe and convenient active transportation. This could include safe, performance-based methods for setting speeds lower than the 85th percentile or demonstrate possible modifications to permitting policy to allow more active transportation in the state ROW.

Potential for Implementation: District Active Transportation Plans; CTP 2050 Implementation and future iterations of the CTP; Safety Plans.

Modeling truck/bus created fugitive dust on highway roadsides with narrow or absent shoulders

Research Need: Most of the existing fugitive dust studies found on a search of the literature investigated dust created by traffic on the paved highway surface. A study completed by the University of Nevada and the San Joaquin Valley Unified Air Pollution Control District in 2011, reports the first empirical estimate of particle emissions from unpaved shoulders of paved roads (H. Moosmüller, J. A. Gillies, C. F. Rogers, D. W. DuBois, J. C. Chow, J. G. Watson & R. Langston (1998) Particulate Emission Rates for Unpaved Shoulders along a Paved Road, Journal of the Air & Waste Management Association, 48:5, 398-407, OI:10.1080/10473289.1998.10463694). This study confirms the theory that large vehicles with poor aerodynamics traveling at high speed result in significant dust entrainment. While not the source of the highest fugitive dust emissions for the basin, depending on conditions, shoulder generated dust could have significant effect on local air quality.

Research Description: The objective of the proposed study would be to model dust plumes to determine extent and volume of dust plume under expected climate change conditions (warmer, drier for longer periods) at different shoulder widths to determine optimal widths of paving necessary to alleviate the additional dust created by an ever-increasing number of large vehicles.

Opportunities for housing the unsheltered on State-owned right of way and associated costs and impacts

Research Need: With California facing an unprecedented crisis of homelessness, Caltrans has sought to use innovative strategies to meet temporary housing needs. What innovative methods of using state-owned right of way for shelter opportunities have worked at other times or in other regions? For instance, what are best practices in the transfer of unused land parcels to entities that are better equipped to provide services to the homeless? What are the associated costs and impacts?

Research Description: Caltrans seeks a study or white paper on potential innovative strategies to address homelessness through the use of state-owned right of way. This may draw on past literature, interviews, case studies, or models to identify methods to enhance feasibility of solutions and assess potential costs and impacts.

Racial equity and the LA Metro consent decree

Research Need: Caltrans and the State of California are prioritizing conversations about equity due in part to the expanding national discussion about race and privilege in the United States. Since transportation projects have impacted people of different races and economic classes differently in the past, and since Caltrans has prioritized equity moving forward, this project can help to analyze existing public transportation infrastructure through the lens of a past equity-based court case.

Caltrans also may need to update their view and understanding of equity in the provision of public transit services as a result of recent race and equity discussions. This project could help us determine if any updates are required to the indicators that were used to prove that a local agency was discriminating against minority groups in the delivery of transportation services.

Research Description: First we will conduct a literature review of earlier research projects on this subject. This will help us secure data that may be usable for our project.

Our second step will be to analyze data presented in the court case, temporary injunction (September 1, 1994) and subsequent consent decree ordered by Judge Terry Hatter in August 1996 (decree was lifted, also by Judge Hatter, in 2006).

Third, we will seek out equivalent data from the current post-decree era. Along with the data, please collect interviews with and feedback from people and community-based organizations in the LACMTA service area, especially from community members with lived experience of discrimination.

After these data are collected, we will analyze the data to answer the following questions:

- How have the demographics of Metrolink customers changed?
- How have the demographics of LACMTA/LA Metro rail customers changed?
- How have the demographics of LACMTA/LA Metro bus customers changed?
- What are the demographics of Metro's Bus Rapid Transit customers (Orange Line, Silver Line)
- Regardless of race, is there a split between the low-income and high-income customers in the above transit modes?

A list of examples of the data can be provided, but the specific data must be identified by the researcher's analysis of the court case documents.

Potential for Implementation: Deliverable will be shared with Modal, CalSTA, Strategic Growth Council, and local Agencies. Depending on the results, a multi-level conference or seminar may be convened to determine need for future research or to write policy. This research may be developed into a policy guide

Regional advance mitigation to expand protection of natural resources and ecosystems

Research Need: Investigate the benefits of establishing statewide priority development and conservation areas to enhance natural ecosystems and encourage preservation of agricultural lands, open space, and critical environmental areas. Study and deploy innovative construction practices that minimize the direct environmental impacts of transportation projects.

Research Description: As our population continues to grow, and our transportation system evolves to better serve it, we must continue to protect California's natural lands, waters, wildlife, and habitats by minimizing the direct environmental impacts of transportation projects. What are some best practices and innovative strategies to improve the effectiveness of natural resources mitigation? What are the actual or anticipated effects of these strategies?

Tolling lessons learned for road usage charge

Research Need: Tolling and road use charge (RUC) systems share many similar administrative issues. As the state considers the feasibility of RUC as a funding alternative, a thorough review of lessons learned from established systems such as Tolling is wise.

Research Description: A literature review of California and other states Tolling practices to determine lessons learned that can be applied to a California RUC. Literature topics include, but are not limited to: administration, enforcement, interoperability, privacy, data security, and liability.

Potential for Implementation: Administrative structures are the most practical and basic brick in the building of a new policy. The ability to avoid problems that occurred in similar policies will be key in setting up a potential road charge program for successful implementation, should elected officials decide to do so.

Tools and best practices in encouraging efficient land use

Research Need: Exploring efficient land use can expand mobility options, reduce travel times, and limit emissions, all while addressing California's housing shortage. Improving accessibility involves bringing origins and destinations closer together, such as housing, schools, shopping, parks, and entertainment. This can be achieved in urban, suburban, and rural parts of the state, not only by concentrating future housing and job growth, but also by improving the balance of different land uses.

Research Description: Provide data and technical tools to help State, regional, and local governments evaluate the transportation impacts of land use decisions. Identify and pursue opportunities in repurpose antiquated land uses such as gas stations, parking lots, and large shopping centers to support compact, mixed-use development and sustainable mobility options. Support local agencies in expanding transit-oriented development.

Potential for Implementation: Improving land use efficiency can lead to gentrification as accessible neighborhoods attract higher-income earners and displace low-income residents from their long-time communities. Policy can be implemented in the short-term to ensure tenant protections, anti-displacement, and housing affordability.

Tools for innovative transportation solutions and concept strategies for system planning

Research Need: Caltrans District Planners are now starting to create an updated version of individual corridor plans and other system planning products. System Planners will need to address new corridor planning issues and scenarios over the 20-year plan horizons. These issues include, but are not limited to, the advancement of new technologies, addressing climate change, reducing Greenhouse gas emissions, as well as social/demographic changes that will impact corridor performance. Further, CA Government Code 65086 directs Caltrans to carry out long-term state highway system planning, and the recently passed Senate Bill 1 requires preference to be given to comprehensive corridor plans that demonstrate collaboration between Caltrans and local or regional partners, and instituting performance measures concerning maintenance and rehabilitation of the state highway system.

Research Description: After determination of System Planning/Corridor Planning needs from the Caltrans Districts, researchers would compile a list of innovative alternative strategies/concepts, create a tool or set of tools that will assist System planners in the development of corridor plans (and other system planning documents) and how best to address a host of innovative alternative strategies, including but not limited to, corridor plan format, graphics, narratives, and performance measures.

Potential for Implementation: As envisioned, the outputs of this research being fact sheets, graphics and citation notes, and would be available on Caltrans' intranet site and made available to all Districts. This would be a tech. transfer process: to make these tools more easily accessible for Caltrans planners and stakeholders.

Transit discount verification and barriers to transit access

Research Need: Getting verified for transit discounts is hard! California Integrated Travel Program (Cal-ITP) is in the process of launching an eligibility verification (EV) service. To do so successfully, it is critical to find out what the barriers and impacts to getting discounted fares are. This research would survey the existing process, identify barriers, and recommend best practices for ITP to follow in statewide EV services.

Research Description: Research the state of eligibility verification services and how best to implement transit benefits statewide. The researchers will survey these services here in California and in select other jurisdictions and then make recommendations for best practices based on the information gathered. The goal is to gain further knowledge on how transit benefits are allocated in CA and determine a path forward to a statewide service, including a documentation of how many riders are eligible but are denied or do not get benefits. The ultimate goal is to make this process easier for transit users. Knowing who gets benefits and who does not, along with a process for making sure that everyone who has eligibility for free or reduced price transit increases equity.

Potential for Implementation: The goal is to develop guidelines for the transit agencies to use in making transit verification as simple as possible and widely used as possible. Transit agencies can then implement this on their systems, and the Cal-ITP project can implement these guidelines as well, making electronic verification across California much more convenient and feasible.

Appendix B - Caltrans DRISI Research Goals

The Caltrans Division of Research, Innovation and System Information (DRISI) "advances California's transportation system, develops comprehensive transportation solutions, and creates and distributes transportation-related knowledge and information." DRISI's purpose and goals support Caltrans' mission to provide a safe, sustainable, integrated, and efficient transportation system to enhance California's economy and livability. Applicants may find it helpful to review DRISI's research goals, below, when considering research topics.

- Critical societal and technological trends for consideration in the California Transportation Plan and subsidiary Caltrans modal plans, including (not limited to):
  - Impacts of shared mobility on vehicle miles traveled (VMT)
  - Transportation-related cybersecurity risk
  - Meeting transportation needs in the midst of changing California demographics
- Implementation of the statewide freight plan and emerging sustainable freight trends, including but not limited to:
  - Methods for determining freight origin and destination
  - Truck parking innovations
  - Modal shifts from trucks to rail or barge
  - Intelligent transportation systems for freight
- Meeting transportation system performance measurement requirements of the FAST Act and California Senate Bill 1, including but not limited to:
  - Data collection needs for new performance metrics in the Caltrans Strategic Management Plan including prosperity, accessibility, livability, and resiliency
  - Best practices in performance-based transportation planning in the U.S.
  - How to use GPS data for mode and activity deduction including how other DOTs use big data
  - How to use Big Data platform for integrating land use and transportation planning
  - How to incorporate contingency planning into corridor planning (Shared mobility (TNCs), AV/CV deployment, Climate Change, economic uncertainty, etc.); how to incorporate health and accessibility scores into corridor planning
  - How to identify data sources and develop parameters for qualitatively ranking critical corridors and optimal projects
  - Improved active transportation safety, mobility, and equity aimed at fostering healthy and sustainable communities, including but not limited to:
    - Access to data need to effectively evaluate systemwide or location-specific safety issues
    - Analysis of benefits and costs of bicycle and ped. safety infrastructure projects
    - Estimating greenhouse gas reduction potential of active transportation facilities
    - Bicycle and pedestrian trip data collection methodology and forecasting
- Tools for assessing lifecycle GHG emissions and costs for highway and other projects, as per Executive Order B-30-15
- Tools for predicting and mapping mudslides as a result of the environmental effects of wildfires
- Case studies in transportation equity.
- Racial history and impacts of transportation decisions in the state of California and at Caltrans

Appendix C - PSR Research Themes

This funding for this RFP is being provided by Caltrans match funding for PSR UTC so proposers should target the priorities in Appendix A. The PSR themes are provided below to provide additional context.

Theme 1: Technology for improved mobility

We are on the threshold of a largely unforeseen technological and social transformation in connectivity, automation, and the sharing economy that promises to revolutionize travel in our Region and beyond. This theme explores technology solutions for improving mobility for both passengers and freight. Our Theme 1 research program is organized around three topic areas.

Topic 1-1: Technology and mobility: This topic examines emerging technologies and their potential for improving passenger and freight mobility. Innovation is rapid across both passenger and freight modes. Examples include smart parking, dynamic routing, delivery consolidations, and integrated transit fare systems, in addition to the well-known transportation network companies (TNCs). This topic examines the potential of these innovations to solve the transport problems of Region 9.

Topic 1-2: Smart infrastructure and vehicles: Technology for connected and autonomous vehicles (CAVs) is advancing rapidly. This topic examines AVs and CAVs. Examples of research include: 1) development of models and algorithms for managing shared CAVs; 2) impacts on travel behavior; 3) impacts on traffic flow and management in mixed fleets; and 4) truck platoons. This topic also examines the potential long term impacts of AVs and CAVs on travel behavior, location choices of households and firms, and metropolitan spatial structure.

Topic 1-3: Public policy and implementation: This topic explores the role of government in technology implementation and regulation. Research is needed on the role of government in this changing environment. A second issue is cooperation. A future of vehicles managed at the system level requires cooperation of public and private entities involved, yet there are many barriers to such cooperation. Finally, there are questions about the viability of CAVs.

Theme 2: Improving mobility for disadvantaged populations

This theme addresses mobility and accessibility problems of disadvantaged populations.

Topic 2-1: Novel modes for improved mobility and accessibility: This topic explores the potential of novel modes, new models of public transport, and new models of private vehicle access to address mobility problems. Research may include challenges to implementation and strategies to overcome them.

Topic 2-2: Land use, accessibility, mobility: Addressing the needs of the disadvantaged includes studying relationships between land use and transport with respect to minority and

disadvantaged populations. This topic examines the impacts of limited accessibility and mobility both in urban and rural areas. It also explores the role of land use policies in reducing access barriers for underrepresented groups.

Theme 3: Improving resilience and protecting the environment

Resilience, or the ability to absorb shocks, recover quickly, and adapt to changing social, economic, and environmental conditions is essential to ensuring well-functioning and sustainable communities. Sustainability also requires reducing environmental problems. This theme addresses all aspects of environmental protection.

Topic 3-1: Analyzing alternative resilience strategies: More effective resilience strategies can reduce the damages of natural disasters, accidents, or terrorist events. There is a need for research on frameworks to analyze resilience strategies at different geographic scales. Effectiveness of resilience strategies is often analyzed via economic impact models. In the case of transportation, these models could be linked with transportation network models to quantify the cost-effectiveness of different strategies. Methods to examine distributional impacts of disruptions and resilience across socioeconomic groups is also needed.

Topic 3-2: Smart technologies: Smart technologies can improve system monitoring. Smart sensing systems, including those powered through solar or power harvesting, can provide the necessary information to monitor the health of systems so that proactive repair and replacement can be dealt with through normal crew duties.

Topic 3-3: Reducing environmental impacts: The challenge for Region 9 is to reduce environmental impacts while meeting the mobility needs of society, fostering healthy communities, and supporting economic growth. Research is needed to address this challenge along three fronts:1) *Infrastructure and operations*: lifecycle use of materials and practices in roadway construction, maintenance, and operation; assessment of environmental implications of Intelligent Transportation System (ITS) strategies; 2) *Travel demand*: effectiveness of strategies for shifting driving to transit, walking, and bicycling; implications of automated cars for land development patterns; role of new mobility services in daily household travel; and 3) *Vehicle and fuel technologies*: assessment of new-generation fuel and vehicle technologies, including battery, plug-in hybrid, roadway-powered, and fuel cell electric vehicles, with respect to lifecycle emissions, private and social costs, consumer behavior, and regulatory and market policies.

Theme 4: Managing mobility in high growth cities and regions

This theme addresses the transportation problems of regions and metro areas experiencing rapid population and employment growth are expecting to continue to grow.

Topic 4-1: Managing passenger demand: This topic explores meeting human needs while lessening travel required. The emphasis is on "accessibility" rather than "mobility." Well-being

is enhanced when people are able to acquire goods and services, employment and education, but not necessarily by increasing travel volume. There is increasing emphasis on combining land use planning with transportation capital investments to achieve efficient movement patterns.

Topic 4-2: Managing freight demand and its impacts: This topic addresses the challenges of managing freight, both last mile and regional. For example, the rise of e-commerce has brought about changes to global and local supply chains and greatly increased urban freight deliveries. The revitalization of our urban cores adds another increase in demand that translates into additional trips made by trucks and delivery vans. Research is needed to examine the impacts of e-commerce and other changes on local and regional mobility, economic activity, and employment patterns, such as passenger-freight conflicts, dynamics of shifts and their local impacts, and effective strategies for managing trade-related traffic, including better balancing demand across time intervals, routes, and modes.

Appendix D - Budget Information and Forms

UCI Budget Form [SAMPLE]

Category	Monthly Salary		% of Time on Program		Number of Months		Budget ($)
Faculty Salary	_____	x	_____	x	_____	=	_____
Faculty Salary1	_____	x	_____	x	_____	=	_____
Student Support	_____	x	_____	x	_____	=	_____
Type of Student	_____						
Student Support*	_____	x	_____	x	_____	=	_____
Type of Student	_____						
Fringe Benefits	Rate _____				Total		_____
Tuition	Units _____		Rate_____		Total		_____
Conference Travel Conference Name/Date _____							_____
Other Travel							_____
Materials and Supplies							_____
Equipment (list) _____ _____							_____
Other Direct Expenses (itemize) _____							_____
Tuition cost share	Units_____		Rate_____		Total		_____
Overhead (20%)							_____
TOTAL FUNDS REQUESTED							_____

*Use additional faculty and student lines only if more than one professor or student.

PSR Cover Page [SAMPLE]

Title _____

Theme _____

Topic Area_____

Caltrans Topic (if applicable)_____

Principal Investigator _____

Mailing Address _____

_____

_____

E-mail _____

Phone _____

Fax _____

Co-Principal Investigator_____

Are you submitting this proposal elsewhere, or are you currently receiving funding in the same area of research? Yes _____ No _____

If yes, please describe circumstances and funding source

Does this proposal comply with the PSR Data Management Plan? Yes No