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

RFP Issued: March 9th, 2022 **(v2, revised March 10th)**

Proposals Due: April 1st, 2022

Selection Notification: May 2022

Anticipated project start date: Fall 2022

Maximum project duration: up to 12 months

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Revisions

- March 9th, 2022: Initial Release
- March 10th, 2022: Added additional Caltrans research statement “Impacts of Changing Agriculture Supply Chains on California Roads and Bridges”. See Appendix A.2.

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 $150,000 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 12 specific research needs statements, which can be found in Appendix A - Caltrans Research Needs for FY 2022-23. 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 may 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 sources) will receive priority consideration. For additional information, contact ITS-Irvine Assistant Director for Research Coordination Craig Rindt <crindt+psr2022@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 prorated 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 2022, 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+psr2022@uci.edu> for questions about creating a budget for PSR proposals. Budgets should assume a start date of 9/16/2022.
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+psr2022@uci.edu **on or before 5:00pm PDT on April 1, 2022**.

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 2022-23**
- **Appendix B - Caltrans DRISI Research Goals**
- **Appendix C - PSR Research Themes**
- **Appendix D - Budget Information and Forms**

Appendix A - Caltrans Research Needs for FY 2022-23

Many of the following Caltrans research needs statements are cross-cutting. It is recommended that applicants review all of the following research needs statements. Direct questions about these statements, including about the research need requestor's contact information, to Craig Rindt.

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.

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.

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).

Quantitative Performance Measures for the Caltrans Strategic Investment Strategy

Research Need: The Climate Action Plan for Transportation Infrastructure (CAPTI), developed by the California State Transportation Agency (CalSTA), identifies key actions necessary for implementation of the CalSTA sections of EO N-19-19 and EO N-79-20. Under CAPTI Strategy 4.1, Caltrans is directed to, "Develop and Implement the Caltrans Strategic Investment Strategy (CSIS) to Align Caltrans Project Nominations with the CAPTI Investment Framework". The Office of Strategic Investment Planning (OSIP) has commenced work on the Interim CSIS, which defines a qualitative assessment of project alignment with the CAPTI Investment Framework. Please see table below, which illustrates alignment of Caltrans Scoring Criteria with CAPTI.

The purpose of this research request is to identify quantitative performance measures and associated data/methodologies for the following criteria:

Criterion	CAPTI Investment Framework	Caltrans Scoring Rubric
Mode Shift	Build toward an integrated, statewide rail and transit network… Invest in networks of safe and accessible bicycle and pedestrian infrastructure…	Does the project demonstrate potential for mode shift, including to rail, transit, or active transportation?
Vehicle Miles Travelled	Promote projects that do not significantly increase passenger vehicle travel…	How does the project impact VMT?
Zero Emission Vehicles	Include investments in light, medium, and heavy-duty ZEV infrastructure… Develop a ZE freight transportation system…	Does the project include and/or improve access to ZEV charging or fueling infrastructure?
Safety	Make safety improvements to reduce fatalities and severe injuries of all users towards zero…	Does the project reduce fatalities and severe injuries for all users in alignment with the Safe Systems Approach?
Climate Adaptation and Resiliency	Assess physical climate risk…	Does the project improve climate adaptation and resiliency by addressing one or more climate risk(s)?
Natural Resources and Ecosystems	Protect natural and working lands…	Does the project minimize the impact on natural resources and ecosystems?
Infill development	Promote compact infill development while protecting residents and businesses from displacement…	Does the project promote infill development and transportation-efficient land use patterns while protecting residents and businesses from displacement?

Research Description: Caltrans requests research be conducted to identify comprehensive sets of quantitative performance measures, descriptions, data sources, and methodologies to assess project alignment with each scoring criterion. OSIP requests identification of multiple quantitative performance measures per criterion to ensure applicability to various project types (highway, rail, active transportation, etc.) and geographies (urban vs. rural).

For each performance measure identified, OSIP requests:

1. Description/definition of quantitative performance measure
2. Data Source
3. Methodology/Calculation
4. Applicable mode(s) of transportation
5. Applicable geographical areas

The anticipated outcome is a robust set of quantitative performance measures and methodologies to assess project alignment with CAPTI. This will result in a data- and performance-driven approach to

project evaluation and nomination will be documented in the final CSIS document and in the 10-Year Non-SHOPP Investment Plan.

Estimating Transit Travel Demand During Wildfire Evacuations

Research Need: Multiple wildfire evacuation events per year have become the norm in California due to the impacts of climate change. Meanwhile, population growth has pushed more residents into wildland-urban interface areas threatened by wildfires. These wildfire events thus have made evacuations more frequent and larger. Previous wildfire evacuations have seen massive congestion on primary evacuation routes. Additionally, many historically-disadvantaged populations, such as low income, minority, low-English-proficiency, senior, and/or disabled individuals, have faced difficulties in evacuations. Mass transit and rail have the potential to serve their travel needs during evacuations. What is needed is an accurate estimation of transit travel demand in wildfire evacuations, so that public transit can be appropriately used to reach those at-risk populations.

Research Description: First, the researchers will take anonymized mobile GPS data (generated from mobile devices) from a wildfire event. Further, the researchers will acquire General Transit Feed Specification-Real Time (GTFS-RT) data for the same wildfire event. By using the mobile GPS and GTFS-RT data, the researchers will estimate when and where transit trips were generated, and which routes were taken. Second, the researchers will survey people from the disadvantaged populations who were ordered to leave from the same event and community stakeholders—including transit agencies, nonprofit organizations, and individual volunteers—who have helped transport these people to safety. The analyses will include how evacuation orders were communicated; how trips were arranged; the routes, vehicles, and personnel deployed to complete the trips; and whose travel needs were not met. Third, the researchers will integrate the above results to estimate spatiotemporal distributions of transit travel demand in wildfire evacuations.

The end product is a research report about 1) how transit vehicles are used during wildfire evacuation events by analyzing mobile GPS and GTFS-RT data; 2) how historically-disadvantaged populations connect with public, nonprofit, and volunteer services to evacuate from wildfires, whose travel needs are not sufficiently met, and how wildfire evacuation plans might be adjusted to optimize these services; and 3) how to accurately estimate the spatiotemporal distributions of transit travel demand (with latent demand considered) in wildfire evacuations. The product will contain recommendations for future research and potential immediate implementation plans or action items to aid disadvantaged populations in future wildfire evacuation events.

Shoulder Width Data Accuracy Improvement

Research Need: The existing dataset used for shoulder widths is derived from the Transportation System Network (TSN) data. The shoulder widths have inconsistencies in accuracy and are not regularly updated. There is a need for understanding the exact widths of shoulders for project planning efforts. Shoulder widths help determine the appropriate bicycle facility treatments. For example, according to the Highway Design Manual, you need a minimum of 4 feet for a class II bike lane. When the data is not reflective of reality, it challenges the validity of assigning bicycle treatments to specific areas. In addition, understanding shoulder widths is helpful for general traffic operations such as emergency access, assigning detours, maintenance efforts, etc.

Research Description: The research will need to determine the best approach for collecting shoulder width data for the whole State Highway System. There are various methods that need to be explored, such as using existing mapping technology, implementing Lidar detection, and even drone technology. The research request will need to include case studies from other transportation agencies for identifying shoulder widths within their transportation network.

The goal of this research request is to identify the best approach for updating shoulder width data for California's State Highway System. Understanding the process will allow Caltrans to develop the accurate shoulder width datasets needed for bicycle treatment decisions and general traffic operation procedures. This improves our understanding of where safe bicycle travel can currently be accommodated.

Active Transportation Trip-Level Amenities Data Scoping

Research Need: There is a need to build a consolidated information repository that helps a planner or traveler understand available bicycle and pedestrian facilities and amenities for a given origin destination. This helps understand how the active transportation network connects to other modes (e.g. Transit). There is no current source of information for bike/ped amenities, like bike racks, bike lockers, ability to take bikes on busses/transit, etc. Creating data for this would improve the ability of Planners to identify what improvements are needed to support bike ped and transit trips. This will help traveler plan their trips.

Research Description: The research would identify data sources and datasets that could be used to help inform transportation planning work, or traveler route/destination choices. This includes identifying data sources and strategies for locating bicycle and pedestrian facility amenities including bike racks, bike lockers, abilities to take bikes on busses/transit, etc.

Latent Active Transportation Methodology

Research need: There is a need to identify latent demand where bicycle and pedestrian counts or activity may be low because no (or inadequate) active transportation facilities exist but could potentially increase if a bicycle/pedestrian facility is implemented or enhanced. The concept of latent demand refers to new goods and services that people would choose if they were available. Latent demand for active transportation facilities would be common in areas where parents are driving children to school/destinations due to inadequate facilities, or lower income households are unable to get to and from their destinations efficiently due to inadequate transportation options. This research addresses our inability to target improvements in areas with high potential for increases in use of Active Transportation modes.

Research Description: The research will need to come up with a latent demand methodology that identifies locations on or near the state highway system with latent demand for building active transportation facilities. The methodology may differ between bicycle and pedestrian specific demand. Ultimately, the methodology will need to include various data sets and a well-informed formula for identifying latent demand. Data that could be influential to the methodology would be various land use, census, community characteristics, and trip-level data.

GIS Mapping of Emergency Evacuation Routes

Research Need: California has seen a significant increase in emergency evacuation events in recent years. Tsunamis, wildfires, floods, landslides, potential dam bursts, and earthquakes are potential natural disasters that California faces now and in the future, most of which will be impacted by climate change. To prevent loss of life, emergency evacuees need safe, efficient, and fast means of evacuation routes. For most Californians, this means that the evacuation routes, typically on the State Highway System, must be identified in advance and maintained such that they can provide transportation during evacuations. To this end, the State passed SB 747, which required local agencies to identify evacuation routes as part of safety elements in the general plan. What is needed is a centralized database of the evacuation routes identified under SB 747 and a study on how these identified routes compare with the latest research on how the public travels during evacuation events and how best to maintain a transportation system to prepare for an evacuation event.

Research Description: The researchers will collect local agencies' safety elements to compile the evacuation routes into a centralized geographic information system (GIS) database. The routes will be compared with the State Highway System and passenger rail and intercity bus routes. These State assets will be identified, and the researchers will compare the assets with previous evacuation events (case studies) and how evacuees traveled. They will compare and see how well those assets align with best practice. The researchers will also make recommendations on how best to maintain State assets in preparation of evacuations based on the latest research.

The end product will be a report and a GIS database. The report will compare the identified SB 747 evacuation routes with case studies of evacuations. It will also make recommendations to transportation leaders on how to maintain State transportation assets to achieve efficiencies and promote safe evacuation routes. The GIS database will contain the routes from local agencies' SB 747 evacuation routes in the safety elements of the general plan. The database will also identify which type of route it is, i.e., if the route is for wildfire, tsunami, or other disaster event.

Untapped Funding Sources: Transportation Funding out of the Transportation Sector

Research Need: Transportation funding sources on its own are complex, often resulting in underutilized funds. Funding is available at the Federal, State, and local levels but additional sources, origin of funds, requirements and deadlines of the funding only add to the complexity for agencies in need. However, not much is known about the funding sources outside the transportation sector or originating in other departments not directly tied to transportation. These untapped funding sources could include transportation uses but do not advertise it as such. Gaining a better understanding of these untapped funds can potentially allow transportation agencies to access vital funding that may not be accessible through traditional transportation funding sources.

Research Description: This research will delve into available funding sources in various departments at the federal and state level to identify funding sources with transportation related uses included in the use of funds. Further, the research will determine if these funding sources have been used for transportation projects before, and if so, how the funds were used.

The goal of this research is to create a comprehensive list of accessible funding sources for transportation agencies to utilize in the future.

Improving access and efficiency to transportation affordability programs in California

Research Need: Despite transportation being the 2nd largest expenditure category for low-moderate income households, frameworks and action for comprehensive transportation affordability support policies lag far behind other basic service (utility, housing, food) sector programs offered at local, state or federal levels. Existing assistance programs often function as discretionary rather than entitlement programs. These programs are first-come, first serve, and often over-subscribed. They tend to use limited dollars to channel large benefits to relatively few beneficiaries, leave many eligible households unassisted, and are rarely evaluated.

Research Description: We propose in this research to compare the availability of and funding for discount programs, eligibility criteria, benefit levels, ease of enrollment, use (including payment means) and other procedural equity considerations, as well as reach to the target population, for securing discounted service or access across major transportation service providers and modes in California. The emphasis would be on reviewing transit discount offerings, but also include the patchwork offering of discounts by agencies for vehicle use (car sharing), vehicle purchase, and piloted approaches for e-bikes and micro-mobility assistance. For a short-term project, this research could focus on understanding the landscape for transportation affordability support and how these programs compare and contrast with other basic service supports, with an eye toward consistency and potential coordination. As a more medium to long term effort/scale, this research could examine the opportunities to actually combine entitlement programs like packaging public transit fare supports and payment with food stamp programs, parallels for which have begun to operate through the emPOWER platform and in CPUC initiatives. This could potentially include piloting programs with partners in government and social service for LA County, as an example.

The desired outcome includes recommending reforms and pathways for scaling, simplifying and making transportation discount programs more impactful for universal mobility and household welfare outcomes.

Student Transportation Proposal

Research Need: California K-12 schools provide transportation for fewer than 1 out of every 12 students (National Household Travel Survey, 2017). The remaining 11 of 12 walk, roll, take private transportation, or take public transit to school. The latter option is part of why a growing number of K 14 educational institutions and universities are offering pass programs that provide students with free access to public transit. The programs currently rely on closed loop smart card systems to identify passholders and provide free access to transit. With a move to open loop payments for transit, new possibilities and challenges may be introduced. To study this potential, two questions are important: Is transit use for travel to/from school good for children? And if it is, how can student transit programs be implemented as transit systems move toward open loop payments?

Research Description: Researchers will first look into how transit use for school trips good for children by reviewing student transportation and school-related travel behaviors in California, as compared with

other states and broken down by school level: Elementary (Kindergarten through Grade 5, ages 5-11), Middle (Grades 6 through 8, ages 12-14), High (Grades 9 through 12, ages 15-18). Researchers will conduct an assessment of student outcomes based on school travel behaviors to determine if transit use is good for children's attendance, academic performance, and social-emotional outcomes as well as the effects of school choice programs (e.g., magnet schools and charter schools) on student transportation.

Researchers will then conduct a survey of current K-12, community college, and university transit pass programs in California, including the following:

- Program use: student sign-up rates, frequency of use, age and other demographic traits of users.
- Metrics: expenditures per student, attributable ridership with local transit agencies. • Payment programs, specifically: Instances where a student ID card is integrated with the transit access pass.
- Other modes available to students in the transit service area

Research will also include reviews of alternative modes of student transportation, including yellow school bus service and private shared mobility and of transportation provision and needs for students with special needs, including students with disabilities, foster youth, and students experiencing homelessness, time permitting.

The desired outcome includes insight into student mobility and access which is essential to address the challenges that could arise as transit agencies transition to open-loop payment systems. This research and discussion on travel needs informs the options for pass eligibility verification when using open loop payment processing will address how student status can be verified through a common multi-agency, multi-pass discount eligibility verification system, such as the statewide system envisions for means tested, disability status, age-based, and other eligibilities.

Impacts of Changing Agriculture Supply Chains on California Roads and Bridges

Research Need: Farming and other agriculture are essential components of the California economy, and rural communities play a critical role. As California faces new challenges related to climate, water resources, and sustainability, this research would develop knowledge to help ensure California's global agrarian competitiveness.

Research Description:

- Examine the historical context of California's agriculture production and transportation networks used in moving products to domestic and international markets.
- Document key farm-to-market routes highway corridors in the state and determine metrics that could be used to influence funding, design, construction, and maintenance of agriculture-dependent highways and intermodal connections.
- Explore policies and best practices for assessing farm-to-market network resiliency & sustainability.
- Develop a template and case studies for how the recommended performance metrics could be applied to future statewide freight plans.

More details are available in Appendix A.2.

Appendix A.2 (Supplemental Research Statement)
Impacts of Changing Agriculture Supply Chains on California Roads and Bridges

Problem Statement

In 2019, California producers sold over $50 billion in agriculture products, ranking first among all U.S. states, and accounting for over 13% of all agriculture cash receipts in the country.[1]

> *The building of the Transcontinental Railroad, which eventually led to the Southern Pacific Railway (SP), forever changed California. Not only did it create a much quicker and simpler way for people to travel to the state from the East Coast and Midwest, it also helped develop trade and farming…*[2]

Historically, California's agriculture industry has evolved differently from the rest of America. During the 20th Century, farmers in many country areas focused on producing a few key commodities like corn, soybeans, and wheat better than global competitors. Rail networks in the Midwest responded in kind by developing high-speed, high-volume grain elevators capable of loading 110 car unit trains in 1 hour or less.

During the mid-19th Century, the focus of California agriculture was on high volume grain production, mainly wheat, but in the early 20th Century, California's farmers began a trend towards diversification:

> *"California grain farms were very large for the day and used labor-saving and scale-intensive technologies, pioneering the adoption of labor-saving gang plows, large headers, and combines…This search for large-scale, labor-saving technologies culminated in the perfection of the world's first commercially successful combined grain harvesters by the Holt Manufacturing Company and other local manufacturers in the early 1880s…Between 1890 and 1914, the California farm economy shifted from large-scale ranching and grain-growing operations to smaller-scale, intensive fruit cultivation. By 1910, the value of intensive crops equaled that of extensive crops, as California emerged as one of the world's principal producers of grapes, citrus, and various deciduous fruits."*[3]

California agriculture is distinct from other national regions in many respects; however, it mirrors national trends in farm consolidation. The average size of farms has increased while the number of farms has decreased. For example, data from the US Department of Agriculture (USDA) shows that between 2000 and 2018, the average California farm increased in size from 318 acres to 350 acres, an increase of 10 percent.

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[1] USDA Economic Research Service 2019.

[2] Oakland Museum of California, *Picture This: California Perspectives on American History.* *http://picturethis.museumca.org/timeline/early-statehood-1850-1880s/railroads-tie-california-rest-nation/info*

[3] Alan L. Olmstead and Paul W. Rhode, *A History of California Agriculture.* The Giannini Foundation of AgricutluralAgricultural Economics, University of California. Dec. 2017 pp. 1 -3.

Another common trend seen in California and the rest of the nation during the late 20th Century is the consolidation of rail lines. In 1917 U.S. railroads operated approximately 254,000 miles of rail lines.[4] Today, there are approximately 140,000 miles of U.S. railroad freight lines. According to www.American-rails.com, California lost roughly 3,500 miles of the nearly 8,400 rail line miles in 1920, resulting in just under 5,000 rail line miles today. The loss of rail lines across the U.S. and in California has resulted from the abandonment of less profitable lines and the consolidation of facilities where commodities are loaded or transloaded to trains.

In California, railroads at one time moved perishable goods from the San Joaquin Valley to domestic markets and international gateways, a service that today relies almost exclusively on trucks. The reduction of rail line miles and connections since the 1920s resulted in a modal shift, forcing farmers to move their produce via rural road systems to local, regional, intra/interstate, and international markets.

While changes in California agricultural transport modes and networks have occurred over the last 100 years, the production, marketing, and transportation of raw and finished agriculture and food products have also deviated dramatically. The agriculture marketing changes have been relatively well documented; however, little or no research exists on the impacts of ag-relate heavy commodity transport and highways impacts.

In 2015, the Fixing America's Surface Transportation Act (FAST Act) passed by Congress calls explicitly upon states to focus efforts on roadways traveled by heavy vehicles:

> *In the case of roadways on which travel by heavy vehicles (including mining, agricultural, energy cargo or equipment, and timber vehicles) is projected to substantially deteriorate the condition of the roadways, a description of improvements that may be required to reduce or impede the deterioration;* (FAST Act Chapter 702, Section 70202).

In 2018, the American Transportation Research Institute conducted a study to examine how well states had complied with the FAST-Act requirements and concluded that with regards to heavy-vehicle routes, "*The vast majority of the nominated freight plans did not address the truck weight criterion in any detail*." (ATRI 2018).

The Infrastructure Investment Job Act, signed into law on November 15, 2021, continues the prioritize the need for assessing and maintaining heavy haul routes by maintaining the requirements established under FAST Act requirements.

Further, in response to the global supply chain crisis and the resulting congestion at the Ports of Los Angeles and Long Beach, California started issuing temporary permits on November 17, 2021, which increased truck weight restrictions from 80,000 to 88,000 pounds until June 30, 2022. However, there is limited research currently available to determine infrastructure and mobility impacts resulting from this change.

Research Objective

Farming and other agriculture are essential components of the California economy, and rural communities play a critical role. As California faces new challenges related to climate, water

[4] American Association of Railroads, *A Short History of U.S. Freight Railroads.* – Fact sheet.

resources, and sustainability, this research would develop knowledge to help ensure California's global agrarian competitiveness.

The Impacts of Changing Heavy Haul Supply Chains on Rural Roads and Bridges research objective is to:

1. Examine the historical context of California's agriculture production and transportation networks used in moving products to domestic and international markets.
2. Document key farm-to-market routes highway corridors in the state and determine metrics that could be used to influence funding, design, construction, and maintenance of agriculture-dependent highways and intermodal connections.
3. Explore policies and best practices for assessing farm-to-market network resiliency and sustainability.
4. Develop a template and case studies for how the recommended performance metrics could be applied to future statewide freight plans.

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