Rural Transportation Districts' Research Needs Survey

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EXECUTIVE SUMMARY

In an effort to improve the safety and efficiency of rural transportation facilities, enhance the mobility of rural travelers and conserve the ecological well being of the environment, the Caltrans Division of Research and Innovation (DRI) Rural Program Steering Committee sought information on rural transportation Districts' challenges, needs and opportunities.

In order to fulfill this request, the Western Transportation Institute (WTI) at Montana State University conducted a survey on Caltrans' behalf to assess rural District research needs. The survey design included 11 questions that were designed to be a combination of multiple-choice and opened-ended questions. Each question addressed one of the following aspects of the research identification process adopted by the research committee.

- Perception of the rural District transportation challenges
- Identification of research priorities of rural transportation Districts
- Identification of research from other states that might be leveraged
- Identification of collaboration strategies among potential partners that may need to be created to address challenges
- Required communication strategies to make research more accessible and to accelerate implementation of research results
- Districts' role and responsibility for research activities
- Evaluation of the Rural Program Steering Committee's effectiveness in addressing rural transportation research needs

WTI conducted the survey using Survey Monkey (an online survey tool) during January 2009. WTI sent the survey web link with an email invitation to participants selected by Caltrans research liaisons. WTI sampled 19 professional staff and received 18 responses, for a strong response rate of 95 percent. However, only 67 percent completed the full survey without skipping any questions.

Survey Discussion

The purpose of the survey was to elicit the opinions and research priorities of the professionals working in various Caltrans Districts, based on their experience in the field or managing day-to-day activities. A majority of respondents indicated that either they were responsible for traffic operations (88 percent), maintenance (47 percent), research and innovation (29 percent), or project implementation (24 percent). Most of the survey questions were designed to promote open discussion of their views.

In order to identify research needs, the survey first asked the respondents to identify transportation challenges they face in their district. Subsequently, the survey asked them to prioritize the challenges and to list any existing projects related to their research challenges and priorities. The most critical data for the objectives of this survey that were obtained from the responses is discussed below.

Rural District transportation challenges

Respondents were asked to select among the challenges that were previously identified, and to rate them according to their applicability for their respective districts. Each potential challenge included a brief description, followed by rating options of low, medium, high, or no opinion. By selecting a rating of high, the respondents were indicating that the challenge is to be addressed as a first priority as compared to other challenges. Respondents selected the following challenges most frequently as high priorities: transportation safety, financial constraints, employee safety, natural disasters, winter operations, property impact, and construction-cost impact. The typical urban-area-related challenges, such as air quality, noise impact and roadway performance, rated as low priorities for rural areas. One of the respondents identified "Multiple Local Jurisdictions & Permitting Agencies" as a challenge in an open-ended answer option, but did not rate it.

Identification of research priorities of rural transportation District

The respondents identified a total of 63 different research priorities in response to the question, "What are the top seven research priorities of your District along with their time line (for example, short-range priority, medium-range priority, long-term priority)?" A short-term priority indicates a challenge that should be addressed immediately or within one to three years. The medium range is for three to five years and the long term is for five to 20 years. For analysis purposes, the 63 research priorities were categorized into nine different areas: rural safety, pavements, corridor management, weather information, human factors, incident management, database resources, rural communication system, and capacity building. Some of the short-term priorities are listed in Table 1. Table 1 does not include research priorities in the areas of pavement and human factors as none of the research priorities from these areas are listed under the short-term priorities.

Table 1: Short-term Research priorities (1-3 years)

Research Areas	Research Priorities
Rural Safety	1. Proactive safety for two- and three-lane roads 2. Accelerated deployment of innovative traffic safety devices 3. Intersection monitoring program at left-turn pockets
Corridor Management	4. Active traffic management
Weather System	5. Ice detection and warning system
Incident Management	6. Incident management 7. Responder 8. Wildlife detection and warning system 9. Identifying high collision-concentration locations
Data	10. Statewide consistency in TMC operations and data capture
Rural Communication System	11. Rural ITS communications 12. SafeTrip-21 13. Model 500, 510, 520 CMS replacements
Capacity Building	14. Employee safety

Relevant research from other states

The survey asked respondents to identify research from other states that might be applicable to Caltrans. The question was divided into two parts: the first part was to identify research by other states and the second part was to identify any barriers in implementing this research at Caltrans. A respondent identified specific research by the Minnesota Department of Transportation and the University of Minnesota about rural stop sign assistance. The identified barriers to implementing research from other states were intellectual property rights and financial constraints.

In addition to the primary focus of the survey—to identify challenges and research needs—a supplementary objective was to identify other non-research needs that would enhance research by making it more accessible or by facilitating implementation. The non-research needs—collaboration strategies, communication strategies, and research roles and participation levels—are discussed below.

Collaboration strategies

Regional partnerships and more innovative solutions may be needed to facilitate development and implementation of strategies to address rural district challenges. Thus respondents were asked to select low-, medium- or high-priority ratings for a list of proposed collaboration strategies between Caltrans and potential partners. The collaboration strategies given the highest priority rating by respondents were:

1. Exchange research documents
2. Maintain focus on short-term-deployment based research
3. Investigate long-term, strategic multi-state initiatives (e.g., COATS, North/West Passage)
4. Improve alignment and leveraging of district, Caltrans and USDOT research

Communication strategies

Enhanced internal and external communication among researchers, Caltrans professionals, and other peered organizations' professionals can make research more accessible and accelerate implementation of research results. Respondents were asked to select low-, medium- or high-priority ratings for a list of proposed communication strategies. The communication strategies given the highest priority rating by respondents were:

1. Inventory of current research conducted throughout Caltrans, including the names of the individuals conducting the research and project descriptions
2. Regional meetings (Western States Forum) where researchers are presenting results of their work
3. Direct one-on-one contact with researchers

In both collaboration and communication, researchers said they preferred state- and regional-level contacts, but said the scope of their research and implementation should be limited to local or parental organizations.

Districts' role and responsibility for research activities

The survey sought to identify the role that respondents want to play in the research activities of their organization. The respondents were given four options; their response to each is given below.

1. Host the research project (provide logistical support, monitor project activities, review results, fully implement the project)
   Response Frequency: 58 percent
2. Provide resources (To provide financial, human and technical resources)
   Response Frequency: 75 percent
3. Be a partner with another district's research efforts
   Response Frequency: 83 percent
4. No participation in research
   Response Frequency: 0 percent

Respondents reported a strong interest in research, as indicated by the fact that none of them selected the "no participation" response. However, the high response rates for options no. 2 ("provide resources") and no. 3 ("be a partner") may indicate that the respondents do not have the institutional authority to select "host a project."

Evaluation of current research efforts

Each professional was asked to rate the effectiveness of the DRI Rural Program Steering Committee in addressing relevant transportation research needs. Overall, the respondents rated the committee's effort as above average.

Next Steps

Based on the survey results, the following steps may be considered in decision-making.

- Review transportation challenges and research needs with earlier efforts.
- Review and evaluate current Caltrans research projects in conjunction with this survey.
- Identify tools to implement collaboration and communication strategies identified in this survey.
- Develop problem statements based on the research needs identified in the survey.

Transportation challenges, needs, and opportunities change over time as they are iterative and constantly in process. The opinion and priorities expressed and identified in this survey are stand alone, unique, valuable and time-bound. In 2008, Research and Deployment Steering Committee (RDSC) approved the strategic research priorities in question format. These research priorities are known as the 38 Strategic Research Questions (SRQs). The research priorities observed from this survey effort differ from those that the RDSC approved. These research priority changes are discussed in 'Key Observation' section. The completed and unedited survey results are provided in Appendix A followed by the 38 strategies research questions (SRQ) and the survey results research comparison in Appendix C.

INTRODUCTION

In an effort to improve the safety and efficiency of rural transportation facilities, enhance the mobility of rural travelers and conserve the ecological well being of the environment, the DRI Rural Program Steering Committee at Caltrans sought information on rural transportation Districts' challenges, needs and opportunities.

In order to fulfill this request, WTI conducted a survey on Caltrans' behalf to assess rural district research needs. The 11 survey questions were designed as a combination of multiple-choice and opened-ended questions. The questions were grouped into four categories, each addressing a specific aspect of the research identification process adopted by the research committee.

Section (1): General Information about Respondents

Question 1: Name

Question 2: District location

Question 3: Position title

Question 4: Transportation areas of responsibilities

Section (2): Research Needs Identification

Question 5: Perception of the rural district transportation challenges

Question 6: Identification of research priorities of rural transportation districts

Question 7: Identification of research from other states that might be leveraged

Section (3): Non-Research Needs Identification

Question 8: Identification of collaboration strategies among potential partners that may need to be created to address challenges

Question 9: Required communication strategies to make research more accessible and to accelerate implementation of research results

Question 10: Districts' role and responsibility for research activities

Section (4): Evaluation of Current Research Efforts

Question 11: Evaluation of the Rural Program Steering Committee's effectiveness in addressing rural transportation research needs

The survey itself did not identify the four sections. Participants were not required to respond to every question.

WTI conducted the survey using Survey Monkey (an online survey tool) during January 2009. Caltrans research liaisons selected agency professionals to participate in the survey. WTI researchers sent the survey web link with an email invitation to the 19 Caltrans staff members on the list. Eighteen responses were received for a strong response rate of 95 percent. However, only 67 percent completed the full survey without skipping any questions.

Respondents were given three weeks to complete the survey. In addition to the initial email invitation, WTI sent two reminder emails on a weekly interval to professionals who had not yet completed the survey. WTI did not offer any incentives for participation, so the high response

rate reflects the professionals' interest in the study process. The survey analysis shows that the respondents took approximately 15 to 20 minutes to complete it. The following section discusses the survey results in detail. The complete and unedited survey results are provided in Appendix A.

SURVEY DISCUSSION

Section 1: General Information

The general goal of the survey was to elicit the opinions and priorities of district professionals based on their experience in the field or managing day-to-day activities. Most of the survey was designed to promote "open discussion" of their views. However, the first four items were included to understand the job responsibilities of the respondents and to determine if all districts were represented in the survey. Identity of the respondents was kept confidential. The response rate to each question varies and is given below.

1. Name

Respondents were asked to provide their names, but the names were not included in the publication of results to ensure confidentiality. The response rate to this question was 78 percent.

2. District/Location Name

Responses indicate that professionals from Districts 1, 2, 4, 5, 6, 8, 9 and 10, and DRI were represented. The response rate for this question was 83 percent.

3. Position Title

Respondents who completed the survey included professionals from the following departments: maintenance and operations, traffic operations, ITS engineering and support, electrical departments, traffic management center, and DRI. The response rate for this question was 83 percent.

4. Transportation Areas of Responsibility

The respondents were asked, *"What area(s) of transportation are you responsible for on a day-to-day basis?"* They were asked to select from the list of options below with an opportunity to select more than one area of responsibility. The response frequency for each transportation area is shown in descending order in Table 2.

Table 2: Transportation area of responsibility

Transportation Areas	Response Frequency (Response Count)
Traffic Operations	88% (15)
Maintenance	47% (8)
Research & Innovation	29% (5)
Project Implementation	24% (4)
Equipment	18% (3)
Procurement and Contracts	18% (3)
Transportation Systems Information	18% (3)
Human Resources	12% (2)

Transportation Areas	Response Frequency (Response Count)
Training	12% (2)
Design	12% (2)
Engineering Services	12% (2)
Mass Transportation	6% (1)
Construction	6% (1)
Information Technology Solutions Division	6% (1)
Infrastructure Division	6% (1)
Project Management	6% (1)
Aeronautics	0% (0)
Transportation Planning	0% (0)
Local Assistance	0% (0)
Rail	0% (0)
Environmental Analysis	0% (0)
Right of Way and Land Survey	0% (0)
Other (please specify)	0% (0)

The table shows that a majority of respondents were responsible for traffic operations (88 percent), maintenance (47 percent), research and innovation (29 percent), and project implementation (24 percent). A cross tabulation survey was performed based on these transportation areas as they are statistically significant due to high response rate. Cross tabulation results are provided in Appendix B. Some transportation areas, such as aeronautics, transportation planning, rail, environmental analysis, and right of way/land survey were not represented at all among survey respondents. The response rate for this question was 89 percent.

Section (2): Research Needs Identification.

In order to identify research needs, the respondents were first asked to identify transportation challenges they face in their district. The survey asked them to prioritize the challenges and to list any current projects related to their research challenges and priorities. The responses to the questions in this section provide some of the most critical data for the objectives of this survey.

5. Rural district transportation challenges

Respondents were asked to select and rate the applicable rural challenges for their respective districts. Each potential challenge included a brief description, followed by rating options of low, medium, high, or no opinion. By selecting a rating of "high," respondents were indicating that the challenge is to be addressed as a first priority as compared to other challenges. Respondents

selected the following challenges most frequently as high priorities: transportation safety, financial constraints, employee safety, natural disasters, winter operations, property impact, and construction cost impact. Typical urban-area-related challenges such as air quality, noise impact and roadway performance rated as low priorities for rural areas. One of the respondents identified "Multiple local Jurisdictions & Permitting Agencies" as a challenge in an open-ended answer option, but did not rate it. The transportation challenges and their ratings are summarized in Table 3.

Table 3: Transportation challenges

Transportation Challenges	**Rating** (Response Count)			
	Low	**Medium**	**High**	**No Opinion**
Transportation Safety (Number of conflict points and accident potential)	0% (0)	7% (1)	**87% (13)**	7% (1)
Financial Constraints (Decreasing level of state and federal funding for transportation projects)	7% (1)	20% (3)	**67% (10)**	7% (1)
Employee Safety	0% (0)	27% (4)	**67% (10)**	7% (1)
Natural Disasters (Earthquake, wildfire, fog, rock slides, etc. that impact transportation operations)	7% (1)	27% (4)	**60% (9)**	7% (1)
Winter Operations	14% (2)	21% (3)	**57% (8)**	7% (1)
Caltrans Property Impact (Degradation of transportation infrastructure)	7% (1)	40% (6)	**47% (7)**	7% (1)
Construction and Maintenance Cost (Effects of rising costs on construction and maintenance schedule of transportation infrastructure)	7% (1)	40% (6)	**47% (7)**	7% (1)
Professional Capacity Building/Training	0% (0)	**53% (8)**	33% (5)	13% (2)
Wildlife and Aquatic Resources (Effects of transportation activities on wildlife and aquatic resources such as wildlife–vehicle crashes)	13% (2)	**53% (8)**	27% (4)	7% (1)
Cultural Impacts (Removal or disruption of cultural landscape features)	20% (3)	**53% (8)**	20% (3)	7% (1)

Transportation Challenges	**Rating** (Response Count)			
	Low	**Medium**	**High**	**No Opinion**
Transportation Coordination (Lack of transportation coordination)	33% (5)	**47% (7)**	13% (2)	7% (1)
Growth Management (Ability to foster mixed use and higher density development in your district as per Regional Growth Management Strategy)	27% (4)	**40% (6)**	27% (4)	7% (1)
Traffic Impact (Traffic pattern changes and volume)	27% (4)	**40% (6)**	27% (4)	7% (1)
Accessibility (Ability to access all major destinations in your district)	33% (5)	**40% (6)**	20% (3)	7% (1)
Visual Impact (Intrusion on existing visual quality)	36% (5)	**43% (6)**	14% (2)	7% (1)
Air Quality Impact (Generation of traffic-related emissions)	**40% (6)**	33% (5)	20% (3)	7% (1)
Roadway Performance (Level of road congestion for all transportation modes)	**47% (7)**	20% (3)	27% (4)	7% (1)
Noise Impact (Increasing noise due to traffic)	**67% (10)**	13% (2)	13% (2)	7% (1)
Other (Multiple local jurisdictions & permitting agencies)				

Cross tabulation of the results with the specific responsibilities of the respondents generated some interesting findings. Professionals responsible for research and innovation, maintenance, traffic operations and project implementation all rated the following challenges as high priorities:

- Transportation Safety
- Financial Constraints
- Employee Safety
- Natural Disasters
- Winter Operations

- Property Impact

However, the research and innovation professionals rated construction and maintenance cost impact as medium, while others rated it high. The traffic operations and maintenance respondents rated the professional capacity building challenge as medium, while the research and innovation respondents gave it a high rating. The response rate for this question was 83 percent.

6. Identification of research priorities of rural transportation district

The respondents identified a total of 63 different research priorities in response to the question, "What are the top seven research priorities of your district along with their time line (for example, short-range priority, medium-range priority, long-term priority)?" The short-term priority indicates a challenge that should be addressed immediately or within one to three years. The medium range is for three to five years and the long term is for five to twenty years. For analysis purposes, the 63 research priorities were categorized into nine different areas: rural safety, pavements, corridor management, weather information, human factors, incident management, database resources, rural communication system, and capacity building. The research priorities are summarized below by category.

Rural Safety

Safety is a critical issue for rural areas. Within this category, respondents have identified nine research priorities. Short-term research priorities include the proactive safety two- and three-lane program, accelerated development of innovative traffic safety, and intersection monitor program at left-turn pockets. Research priorities such as automated or augment speed enforcement and coordinating the department's safety program according to the new Federal Traffic Safety Manual were given medium-range priority. Overall, respondents rated rural safety research issues as either short-term or medium-term priorities.

Pavements

In the pavement research area, respondents identified four research priorities. Winter operations research such as asphalt pavement performance in cold weather areas and effective paving materials that reduce ice and snow accumulation were identified as medium-range priorities. Respondents also listed recycled pavements as a research priority, but for the long term.

Corridor Management

For this research area, respondents identified 11 different research priorities: corridor management, congestion management, evaluation of demand management strategies, transportation system reliability, congestion management, low-cost derangement strategies, and bus rapid transit system for rural areas These priorities were rated as either medium or long term, except active traffic management, which was identified as a short-term priority.

Weather Information

For this research area, respondents identified six research priorities. In general, weather information research challenges were rated as medium- and long-term priorities, except for the ice detection and warning system, which was listed a short-term research priority. All of the challenges listed in this area (other than the ice detection and warning system) were related to dissemination of travel information on highway conditions.

Human Factors

For this research area, four research priorities were rated. Of note, IntelliDrive (Vehicle Infrastructure Integration) issues were listed either as a medium- or long-range research priority, and driving distraction/impaired driving was listed as a medium-range priority.

Incident Management

In the incident management area, respondents identified seven research priorities, including identifying high collision concentration locations, incident detection and management, wildlife detection and warning system, run-off-the-road accidents, and loss of communication at incident locations. All of the research issues were listed as short-term priorities except for run-off-the-road accidents (long term) and incident detection (medium term).

Data

Respondents identified six database-management-related research needs, including traffic safety data collection and supporting structure, consistency in database at traffic management centers (TMCs), and emergency management system control applications. The database consistency and capabilities at TMCs were rated as short-term priorities, and other research issues related to database development methodologies were rated as medium-term priorities.

Rural Communication System

In this research section, respondents identified 10 research needs, including ITS warning systems, motorist information, replacement of older technologies, design guidelines for ITS equipment, and communication challenges at traffic management centers. Research needs related to communication equipment development methodology are listed as medium- or long-term priorities, which is consistent with the responses in the Database Resources section. Unimplemented ITS and replacement of older technologies were prioritized as short-term research needs.

Capacity Building

In this section, respondents identified four research priorities. Effective professional capacity building in technology areas—especially for traffic management centers—is a challenging task, and was identified as a medium- to long-term research priority. Employee and worker safety research issues were rated as short-term priorities.

In general, research priorities related to context-sensitive solutions and technology implementation are rated for short term where expected results of the implementation could be achieved with immediate effects. An example of this is deployment of innovative traffic safety devices on rural roads. Research priorities that need extensive data collection and analysis rated as medium range. Research priorities that need a technology or methodology development are rated as long term. Capital-improvement-related research needs are rated as on-going priorities. The response rate for this question was 83 percent

7. Relevant research from other states

The survey asked respondents to identify research from other states that might be applicable to Caltrans. The question was divided into two parts: the first part was meant to identify research by other states and the second part was to identify any barriers in implementing this research at Caltrans.

None of the respondents provided a complete answer. Only one respondent identified specific research, in this case by the Minnesota Department of Transportation and the University of Minnesota about rural stop sign assistance. However, this response did not include any discussion of the barriers to implementation. Other respondents gave general ideas about research or barriers to implement research without any specific reference.

This survey question received a total of six responses. However, only four responses contained substantive content, which translates to a response rate for this question of 21 percent—lowest in the entire survey.

Section (3): Non-research needs identification

In addition to the primary focus of the survey—to identify challenges and research needs—a supplementary objective was to identify other needs that would enhance research by making it more accessible or by facilitating implementation. Questions in this section addressed collaboration strategies, communication strategies, and research roles and participation levels. These non-research needs are discussed below, with full questions and responses included in Appendix A.

8. Collaboration strategies

To address rural district challenges, regional partnerships and more innovative solutions may be needed to facilitate development and implementation. Thus respondents were asked to select low-, medium-, or high-priority ratings for a list of proposed collaboration strategies between Caltrans and potential partners. Based on the responses, the research team has categorized the strategies into three priority levels:

<u>High-priority strategies:</u>

- Exchange research documents
- Maintain focus on short-term-deployment-based research
- Investigate long-term, strategic multi-state initiatives (e.g., COATS, North/West Passage)
- Improve alignment and leveraging of district, Caltrans and USDOT research

<u>Medium-priority strategies:</u>

- Improve alignment and leveraging of district, Caltrans and USDOT research (also rated as a high-priority strategy)
- Create regional, multi-district working groups to identify research needs and partners
- Serve on regional work groups
- Review regional research activities

<u>Low-priority strategies:</u>

- Address mandates for regional coordination from your district

Cross tabulation of the results with the specific responsibilities of the respondents generated slightly different findings. Professionals responsible for research and innovation, maintenance, traffic operations and project implementation rated the following strategies as high priority:

- Investigate long-term, strategic multi-state initiatives (e.g., COATS, North/West Passage)
- Review regional research activities
- Exchange research documents

The difference in responses suggests that there is a correlation between the transportation challenges and responsibilities in respondents' districts and their perception of research needs.

The response rate for this section of the survey was 66 percent.

9. Communication strategies

Enhanced internal communication can make research more accessible and accelerate implementation of research results. Respondents were asked to select low-, medium- or high-priority ratings for a list of proposed internal communication strategies. Based on the responses, the research team has categorized the strategies into three priority levels:

High-priority strategies:

- Inventory of current research conducted throughout Caltrans including the names of the individuals conducting the research and project descriptions
- Regional meetings (Western States Forum) where researchers are presenting results of their work
- Direct one-on-one contact with researchers

Medium-priority strategies:

- Summarized data that has been interpreted by the researcher who collected the data
- Research results interpreted by individuals within your organization or another third party
- Access to databases that contain raw research data

The first and second strategies in this section were also rated as high priority by an equal number of respondents.

Low-priority strategies:

- Raw research data provided directly from a researcher

Interestingly, cross tabulation of results by job responsibility of the respondents (research and innovation, maintenance, etc.) yielded ratings of the above strategies in the same order. In both result interpretation methods (simple analysis and cross-tabulation), the respondents gave a low rating to the strategy of raw research data provided directly from a researcher.

This section's survey response rate was 66 percent.

10: District role and responsibility for research activities

The purpose of this was to identify the role that respondents want to play in the research activities of their organization. The respondents chose the following options out of the four options provided.

- Host research project (To provide logistical support, monitor project activities, review results, fully implement the project)
  Response Frequency: 58 percent
- Provide resources (To provide financial, human and technical resources)
  Response Frequency: 75 percent
- Be a partner with another district's research efforts
  Response Frequency: 83 percent
- No participation in research
  Response Frequency: 0 percent

All respondents have a strong interest in research, as indicated by the fact that none of them selected the "no participation" response. However, the high response rates for options no. 2 ("provide resources") and no. 3 ("be a partner") may indicate that many of the respondents do not have the institutional authority to select "host a project." This is evident from the cross-tabulation of the results by area of responsibility. The research and innovation professionals gave a high response to the second choice—provide resources. The maintenance and traffic operations professional gave a high response to the third choice—be a partner with another district's research efforts. The project implementation professionals gave an equal response to all options.

The response rate for this section's questions was 66 percent.

Section (4): Evaluation of current research efforts.

11. Addressing transportation research needs?

Each professional was asked to rate the effectiveness of the DRI Rural Program Steering Committee in addressing the relevant transportation research needs. Overall, the respondents rated the committee's effort as above average. The response rate for this question was 56 percent.

Key Observations from the Survey

- None of the professionals selected for the survey represented aeronautics, transportation planning, freight, local assistance, rail, environmental analysis, or right of way and land survey transportation areas.
- Transportation challenges that are critical for urban areas such as noise impact, roadway performance and air quality were rated as low priority for rural areas.
- Transportation planning, assessment and growth management, and impact-related challenges were rated as medium priority.
- Research priorities that need extensive data collection and analysis rated as medium range.
- Research priorities related to context-sensitive solution and technology implementation are rated for short term where expected results of the implementation could be achieved with immediate effects.
- Research priorities that need a technology or methodology development were rated as long range.
- Capital-improvement-related research needs were rated as on-going priorities.
- Investigate long-term, strategic multi-state initiatives (e.g., COATS, North/West Passage) and exchange research documents were rated the most preferred collaboration strategies.
- Inventory of current research, regional meetings (Western States Forum), and direct one-on-one contact with researchers were rated the most preferred communication strategies.
- Be a partner with another district's research efforts was rated the most preferred role to play by respondents, followed by the provide resources (To provide financial, human and technical resources) option.
- Rural Program Steering Committee's success was rated as above average.

Research comparison between the 38 Strategic Research Questions and the survey results

Transportation challenges, needs, and opportunities change over time as they are iterative and constantly in process. Research and Deployment Steering Committee (RDSC) prioritized the 38 strategies research questions (SRQs) for Fiscal Year 08/09. These priorities might have changed and these survey results could provide assistance in updating those priorities. Further, one of the objectives of this survey was to identify research needs that were not identified in the 38 strategic SRQs. Purpose and research identification process of the 38 SRQs and the survey results are different. Thus, the research priorities comparison would be more of a trend analysis.

Strategic research priorities of the 38 SRQs were compared with short-range and short/medium-range research priorities of the survey. Strategic research priorities of freight, environment (especially climate change) and infrastructure areas were no longer prioritized as short-range but communication, and fiscal areas were rated as short-range priorities for the survey. However, research priorities in data, safety and corridor management areas remained as short-range priorities that needed to be addressed in one to three years. Priorities selection might have changed due to sample selection of the survey, economic recession and natural calamities issues.

The 38 SRQs Best practices were compared with medium-range research priorities trend of the survey. Incident management, fiscal, worker safety, capacity building (employee retention) areas' research priorities of Best practices were shifted to short-range priorities in the survey. Transportation infrastructure, coordination, and corridor management (especially pavement, structure etc) areas research priorities shifted to medium or long-range priorities in the survey.

Natural and physical environment related areas' research priorities of Best practices were rated as long-range for the survey. However, human factor, assessment management, planning areas' research priorities of Best practices remained as medium-range for the survey. Low research priorities of the 38 SRQs in the area of fiscal and capacity building were shifted to short-range for the survey. This comparison shows that there are significant changes in research priorities. A comprehensive list of research needs may be prepared or updated with the survey results. The 38 SRQs and the survey results may fill research need gaps to each other. A complete research priorities comparison is included in Appendix C.

Next Steps

The following steps may be considered in decision-making.

- Develop problem statements based on the research needs identified in the survey.
- Update and review priorities of the 38 DRI questions based on the survey results if required.
- Review transportation challenges and research needs with earlier efforts.
- Review and evaluate current Caltrans research projects in conjunction with this survey.
- Identify tools to implement collaboration and communication strategies identified in this survey.
- Prepare an inventory of relevant research from other states.
- Conduct outreach to districts.

APPENDIX A: SURVEY QUESTIONS

This appendix contains a complete list of survey questions followed by detailed response data.

1. Name

The response rate for this question was 78 percent.

2. District/Location Name

Professionals from Districts 1, 2, 4, 5, 6, 8, 9 and 10, and the Division of Research and Innovation located at Sacramento responded to the question about their work location. The response rate for this question was 83 percent.

3. Your Position Title

Respondents who completed the survey included professionals from the following departments: maintenance and operations, traffic operations, ITS engineering and support, electrical departments, traffic management center, and the Division of Research and Innovation. The response rate for this question was 83 percent.

4. What area(s) of transportation are you responsible for on a day-to-day basis?

Transportation Areas	**Response Frequency** (Response Count)
Equipment	18% (3)
Research & Innovation	29% (5)
Aeronautics	0% (0)
Mass Transportation	6% (1)
Transportation Planning	0% (0)
Construction	6% (1)
Human Resources	12% (2)
Procurement and Contracts	18% (3)
Training	12% (2)
Information Technology Solutions Division	6% (1)
Infrastructure Division	6% (1)
Maintenance	47% (8)
Traffic Operations	88% (15)
Local assistance	0% (0)
Rail	0% (0)
Transportation Systems Information	18% (3)
Design	12% (2)

Transportation Areas	Response Frequency (Response Count)
Engineering Services	12% (2)
Environmental Analysis	0% (0)
Project Management	6% (1)
Right of Way & Land Survey	0% (0)
Project Implementation	24% (4)
Other (please specify)	0% (0)

5. Please rate the following applicable rural transportation challenges for your district.

Transportation Challenges	Rating			
	Low	Medium	High	No Opinion
Roadway Performance (Level of road congestion for all transportation modes)	**47% (7)**	20% (3)	27% (4)	7% (1)
Transportation Safety (Number of conflict points and accident potential)	0% (0)	7% (1)	**87% (13)**	7% (1)
Transportation Coordination (Lack of transportation coordination)	33% (5)	**47% (7)**	13% (2)	7% (1)
Accessibility (Ability to access all major destinations in your district)	33% (5)	**40% (6)**	20% (3)	7% (1)
Caltrans Property Impact (Degradation of transportation infrastructure)	7% (1)	40% (6)	**47% (7)**	7% (1)
Growth Management (Ability to foster mixed use and higher density development in your district as per Regional Growth Management Strategy)	27% (4)	**40% (6)**	27% (4)	7% (1)
Traffic Impact (Traffic pattern changes and volume)	27% (4)	**40% (6)**	27% (4)	7% (1)
Noise Impact (Increasing noise due to traffic)	**67% (10)**	13% (2)	13% (2)	7% (1)
Visual Impact (Intrusion on existing visual quality)	36% (5)	**43% (6)**	14% (2)	7% (1)

Transportation Challenges	Rating			
	Low	Medium	High	No Opinion
Air Quality Impact (Generation of traffic-related emissions)	**40% (6)**	33% (5)	20% (3)	7% (1)
Cultural Impacts (Removal or disruption of cultural landscape features)	20% (3)	**53% (8)**	20% (3)	7% (1)
Financial Constraints (Decreasing level of state and federal funding for transportation projects)	7% (1)	20% (3)	**67% (10)**	7% (1)
Wildlife and Aquatic Resources (Effects of transportation activities on wildlife and aquatic resources such as wildlife–vehicle crashes)	13% (2)	**53% (8)**	27% (4)	7% (1)
Construction and Maintenance Cost (Effects of rising costs on construction and maintenance schedule of transportation infrastructure)	7% (1)	40% (6)	**47% (7)**	7% (1)
Natural Disasters (Earthquake, wildfire, fog, rock slides etc. that impact transportation operations)	7% (1)	27% (4)	**60% (9)**	7% (1)
Employee Safety	0% (0)	27% (4)	**67% (10)**	7% (1)
Winter Operations	14% (2)	21% (3)	**57% (8)**	7% (1)
Professional Capacity Building/Training	0% (0)	**53% (8)**	33% (5)	13% (2)
Other (Multiple Local Jurisdictions & Permitting Agencies)				

6. What are the top seven research priorities of your district along with their time line (for example, short-range priority, medium-range priority, long-term priority)?

(Note: In survey results, research priorities were not categorized. For analysis purpose, research priorities are categorized and subjected to change).

Research Priorities	Priorities			
Rural Safety	**Short Range**	**Medium Range**	**Long Range**	**On-Going**
Rural highway safety improvements				♦
Improving safety		♦	♦	
Proactive safety two- and three-lane program	♦			
Coordinating the department's safety program with the new Federal Traffic Safety Manual		♦		
Automated speed enforcement		♦		
Accelerated deployment of innovative traffic safety devices	♦			
Improve intersection safety		♦		
Intersection monitoring program at left-turn pockets	♦			
Automated or augmented speed enforcement		♦		
Pavements	**Short Range**	**Medium Range**	**Long Range**	**On-Going**
Improve asphalt pavement performance in cold weather areas			♦	
Recycled pavements		♦		
Winter operations		♦		
Improving winter operations		♦	♦	
Effective paving materials that reduce ice and snow accumulation		♦		

Corridor Management	**Short Range**	**Medium Range**	**Long Range**	**On-Going**
Travel times & detours		♦		
Corridor management		♦		
Low-cost corridor modeling on rural routes with combination at-grade and grade-separated intersections		♦		
Evaluation of demand management strategies in a rural setting		♦		
Active traffic management	♦			
Congestion management			♦	
Evaluation of effective bus rapid transit options in a rural setting			♦	
State highways as main streets				♦
Best practices used around the state in all rural districts		♦		
Incorporating low-cost demand management strategies in the transportation system		♦		
Improving transportation system reliability		♦	♦	
Weather System	**Short Range**	**Medium Range**	**Long Range**	**On-Going**
Ice detection and warning system	♦			
RWIS maintenance, calibration and cost reduction		♦		
Improving meteorological data use for maintenance decision support		♦	♦	
Traveler information of highway conditions		♦		
Weather systems		♦		
Designing an open source/mixed vendor/component RWIS system			♦	

Human Factor	**Short Range**	**Medium Range**	**Long Range**	**On-Going**
IntelliDrive		♦		
IntelliDrive Implementation			♦	
Driving distractions		♦		
Impaired driving		♦		
Incident Management	**Short Range**	**Medium Range**	**Long Range**	**On-Going**
Incident Management	♦			
Responder	♦			
Transportation Management Systems geared towards Rural incident management	♦			
Wildlife detection and warning system	♦			
Identifying high collision concentration locations	♦			
Minimize consequences of run-off-the-road accidents			♦	
Incident detection		♦		
Data	**Short Range**	**Medium Range**	**Long Range**	**On-Going**
Methodology for future traffic safety data collection and supporting database structure		♦		
Statewide consistency in TMC operations	♦			
EMS control application	♦			
Data capture at TMC facilities	♦			
Data resources for TMC operations/emergency operations		♦		
Low-cost data communication methods from rural TMS to transportation centers		♦		

Rural Communication Systems	**Short Range**	**Medium Range**	**Long Range**	**On-Going**
Rural communications systems		♦	♦	
Rural ITS communications	♦			
Rural ITS warning systems	♦			
Effectiveness of signs in communicating information to drivers on rural high-speed roads			♦	
Motorist information	♦			
SafeTrip-21;	♦			
Solar design guidelines for ITS equipment, similar to Sandia Labs design handbooks		♦		
Improving traveler pre-trip planning			♦	
Model 500, 510, 520 CMS replacements	♦			
Communications challenges TMC to field and TMC to TMC				
Interoperability between TMCs		♦		
Capacity Building	**Short Range**	**Medium Range**	**Long Range**	**On-Going**
Staff development at TMCs		♦		
Effective professional capacity building in technology areas		♦	♦	
Employee safety	♦			
Worker safety	♦			

7. Are you aware of research being conducted in other states or countries that may be applicable to Caltrans and your district? If yes, please provide the details and references. What are the barriers to implementation and strategies that you feel are necessary to implement this research within Caltrans?

Rural Stop Sign Assistance—MinnDOT and the University of Minnesota; objective is to reduce the number and severity of crashes at rural stop-sign-controlled intersections
Know of none.
No. There is no communication to rural sections.
One research barrier is the way California treats intellectual property rights. If we don't consider intellectual property "Public Domain" it is difficult to move from research to production. By insisting that California retain all intellectual property rights and charge manufactures royalty fees, the step from research to production gets very complicated if not impossible. Currently the likelihood of research resulting in production of real products is low.
N/A
Yes, I am aware of research in other states and countries. Barriers to implementation include designing solutions that are robust and reliable, as well as intellectual property issues. In the next few years, I see research taking a backseat in California as we try to untangle the financial mess we are in.
Animal–Vehicle Crash Mitigation—being performed by various researchers at various sites.
Funds to construct strategies in rural settings. Urban settings have a better chance on cost–benefit methods for securing funds.

8. To address rural district challenges, regional partnerships and more innovative solutions may be needed. Please rate the following collaboration strategies between Caltrans and other potential partners.

Collaboration Strategies	Rating				
	Low	Medium	High	No Opinion	Rating Average
Maintain focus on short-term deployment based research	0% (0)	42% (5)	**50% (6)**	8% (1)	2.33
Investigate long-term strategic multi-state initiatives (i.e. COATS, North/West Passage)	8% (1)	33% (4)	**50% (6)**	8% (1)	2.25
Improve alignment and leveraging of District, Caltrans and USDOT research	0% (0)	**42% (5)**	**42% (5)**	17% (2)	2.08
Create regional, multi-District working groups to identify research needs and partners	8% (1)	**42% (5)**	33% (4)	17% (2)	1.92
Address mandates for regional coordination from your District	**42% (5)**	17% (2)	25% (3)	17% (2)	1.50
Serve on regional work groups	8% (1)	**58% (7)**	17% (2)	17% (2)	1.75
Review regional research activities	0% (0)	**50% (6)**	42% (5)	8% (1)	2.25
Exchange research documents	0% (0)	17% (2)	**75% (9)**	8% (1)	2.58

9. In order to make research more accessible and accelerate implementation of results, please rate the following internal communication strategies.

Communication Strategies	Rating				
Answer Options	**Low**	**Medium**	**High**	**No Opinion**	**Rating Average**
Direct one-on-one contact with researchers	8% (1)	25% (3)	**58% (7)**	8% (1)	2.33
Raw research data provided directly from a researcher	**42% (5)**	33% (4)	17% (2)	8% (1)	1.58
Access to databases that contain raw research data	17% (2)	**42% (5)**	33% (4)	8% (1)	2.00
Summarized data that has been interpreted by the researcher that collected the data	0% (0)	**50% (6)**	**50% (6)**	0% (0)	2.50
Research results interpreted by individuals within your organization or another third party	0% (0)	**50% (6)**	**50% (6)**	0% (0)	2.50
Inventory of current research conducted throughout Caltrans including the names of the individuals conducting the research and project descriptions	0% (0)	17% (2)	**75% (9)**	8% (1)	2.58
Regional meetings (Western States Forum) where researchers are presenting results of their work	0% (0)	25% (3)	**75% (9)**	0% (0)	2.75
Other (please specify)					

10. What role do you and/or your district want to play with regard to research projects?

Types of Role	Response Frequency
Host research project (To provide logistical support, monitor project activities, review results, fully implement the project)	58%
Provide resources (To provide financial, human and technical resources)	75%
Be a partner with another district's research efforts	83%
No participation	0%
Other (please specify)	0%

11. Is the Division of Research and Innovation Rural Program Steering Committee addressing your transportation research needs?

Answer Options	Not addressing any needs		Addressing some needs		Addressing all needs	**Rating Average**
Addressing Needs	0%	20%	20%	60%	0%	**3.40**
(Response Counts)	(0)	(2)	(2)	(6)	(0)	

APPENDIX B: CROSS TABULATION RESULTS

Note: A cross tabulation analysis was performed for the questions 5, 8, 9 and 10 only.

5. Please rate the following applicable rural transportation challenges for your District.

Transportation Challenges	Priority	Transportation Areas			
		Research & Innovation	Maintenance	Traffic Operations	Project Implementation
Roadway Performance (Level of road congestion for all transportation modes)	Low	100% (5)	38% (3)	39% (5)	50% (2)
	Medium	0% (0)	38% (3)	23% (3)	0% (0)
	High	0% (0)	25% (2)	31% (4)	50% (2)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Transportation Safety (Number of conflict points and accident potential)	Low	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	0% (0)	13% (1)	8% (1)	25% (1)
	High	100% (5)	88% (7)	85% (11)	75% (3)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Transportation Coordination (Lack of transportation coordination)	Low	60% (3)	50% (4)	31% (4)	25% (1)
	Medium	40% (2)	38% (3)	46% (6)	50% (2)
	High	0% (0)	13% (1)	15% (2)	25% (1)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Accessibility (Ability to access all major destinations in your District)	Low	20% (1)	50% (4)	39% (5)	25% (1)
	Medium	60% (3)	50% (4)	39% (5)	75% (3)
	High	20% (1)	0% (0)	15% (2)	0% (0)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Caltrans Property Impact (Degradation of transportation infrastructure)	Low	20% (1)	13% (1)	8% (1)	0% (0)
	Medium	40% (2)	25% (2)	39% (5)	25% (1)
	High	40% (2)	63% (5)	46% (6)	75% (3)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Growth Management (Ability to foster mixed use and higher density development in your district as per Regional Growth Management Strategy)	Low	60% (3)	38% (3)	23% (3)	25% (1)
	Medium	40% (2)	38% (3)	39% (5)	50% (2)
	High	0% (0)	25% (2)	31% (4)	25% (1)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Traffic Impact (Traffic pattern changes and volume)	Low	60% (3)	25% (2)	15% (2)	0% (0)
	Medium	40% (2)	50% (4)	46% (6)	75% (3)
	High	0% (0)	25% (2)	31% (4)	25% (1)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)

Transportation Challenges	Priority	Transportation Areas			
		Research & Innovation	Maintenance	Traffic Operations	Project Implementation
Noise Impact (Increasing noise due to traffic)	Low	80% (4)	88% (7)	69% (9)	75% (3)
	Medium	0% (0)	13% (1)	15% (2)	25% (1)
	High	20% (1)	0% (0)	8% (1)	0% (0)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Visual Impact (Intrusion on existing visual quality)	Low	20% (1)	43% (3)	42% (5)	33% (1)
	Medium	60% (3)	57% (4)	42% (5)	68% (2)
	High	20% (1)	0% (0)	8% (1)	0% (0)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Air Quality Impact (Generation of traffic-related emissions)	Low	60% (3)	50% (4)	39% (5)	25% (1)
	Medium	20% (1)	38% (3)	39% (5)	50% (2)
	High	20% (1)	13% (1)	15% (2)	25% (1)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Cultural Impacts(Removal or disruption of cultural landscape features)	Low	20% (1)	25% (2)	23% (3)	25% (1)
	Medium	80% (4)	63% (5)	46% (6)	50% (2)
	High	0% (0)	13% (1)	23% (3)	25% (1)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Financial Constrains (Decreasing level of state and federal funding for transportation projects)	Low	20% (1)	13% (1)	8% (1)	25% (1)
	Medium	20% (1)	38% (3)	23% (3)	25% (1)
	High	60% (3)	50% (4)	62% (8)	50% (2)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Wildlife and Aquatic Resources (Effects of transportation activities on wildlife and aquatic resources such as wildlife and vehicle crashes)	Low	20% (1)	25% (2)	15% (2)	25% (1)
	Medium	60% (3)	38% (3)	46% (6)	25% (1)
	High	20% (1)	38% (3)	31% (4)	50% (2)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Construction and Maintenance Cost (Effects of rising cost(s) on construction and maintenance schedule of transportation infrastructure)	Low	20% (1)	13% (1)	8% (1)	25% (1)
	Medium	60% (3)	38% (3)	31% (4)	25% (1)
	High	20% (1)	50% (4)	54% (7)	50% (2)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Natural Disasters (Earthquake, wildfire, fog, rock slides etc. which impact transportation operations)	Low	0% (0)	13% (1)	8% (1)	25% (1)
	Medium	0% (0)	25% (2)	31% (4)	0% (0)
	High	100% (5)	63% (5)	54% (7)	75% (3)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)

Transportation Challenges	Priority	Transportation Areas			
		Research & Innovation	Maintenance	Traffic Operations	Project Implementation
Employee Safety	Low	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	40% (2)	25% (2)	23% (3)	25% (1)
	High	60% (3)	75% (6)	69% (9)	75% (3)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Winter Operations	Low	0% (0)	0% (0)	17% (2)	0% (0)
	Medium	20% (1)	14% (1)	17% (2)	0% (0)
	High	80% (4)	86% (6)	58% (7)	100% (4)
	No Opinion	0% (0)	0% (0)	8% (1)	0% (0)
Professional Capacity Building/ Training	Low	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	40% (2)	50% (4)	46% (6)	25% (1)
	High	60% (3)	50% (4)	39% (5)	75% (3)
	No Opinion	0% (0)	0% (0)	15% (2)	0% (0)

8. To address rural District challenges, regional partnership and more innovative solutions may be needed. Please rate the following collaboration strategies between Caltrans and other potential partners.

Collaboration Strategies	Priority	Transportation Areas			
		Research & Innovation	Maintenance	Traffic Operations	Project Implementation
Maintain focus on short-term deployment based research	Low	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	60% (3)	50% (3)	30% (3)	50% (2)
	High	20% (1)	33% (2)	60% (6)	50% (2)
	No Opinion	20% (1)	17% (1)	10% (1)	0% (0)
Investigate long-term strategic multi-state initiatives (i.e. COATS, North/West Passage))	Low	0% (0)	17% (1)	10% (1)	25% (1)
	Medium	20% (1)	33% (2)	40% (4)	0% (0)
	High	80% (4)	50% (3)	40% (4)	75% (3)
	No Opinion	0% (0)	0%	10%	0%
Improve alignment and leveraging of District, Caltrans and USDOT research	Low	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	60% (3)	33% (2)	30% (3)	25% (1)
	High	20% (1)	50% (3)	50% (5)	50% (2)
	No Opinion	20% (1)	17% (1)	20% (2)	25% (1)

Collaboration Strategies	Priority	Transportation Areas			
		Research & Innovation	Maintenance	Traffic Operations	Project Implementation
Create regional, multi-District working groups to identify research needs and partners	**Low**	20% (1)	17% (1)	10% (1)	25% (1)
	Medium	60% (3)	50% (3)	40% (4)	25% (1)
	High	20% (1)	33% (2)	30% (3)	50% (2)
	No Opinion	0% (0)	0% (0)	20% (2)	0% (0)
Address mandates for regional coordination from your District	**Low**	60% (3)	50% (3)	40% (4)	50% (2)
	Medium	20% (1)	17% (1)	10% (1)	25% (1)
	High	0% (0)	17% (1)	30% (3)	25% (1)
	No Opinion	20% (1)	17% (1)	20% (2)	0% (0)
Serve on regional work groups	**Low**	0% (0)	17% (1)	10% (1)	0% (0)
	Medium	80% (4)	50% (3)	50% (5)	50% (2)
	High	20% (1)	33% (2)	20% (2)	50% (2)
	No Opinion	0% (0)	0% (0)	20% (2)	0% (0)
Review regional research activities	**Low**	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	40% (2)	33% (2)	40% (4)	25% (1)
	High	60% (3)	68% (4)	50% (5)	75% (3)
	No Opinion	0% (0)	0% (0)	10% (1)	0% (0)
Exchange research documents	**Low**	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	20% (1)	17% (1)	20% (2)	25% (1)
	High	80% (4)	83% (5)	70% (7)	75% (3)
	No Opinion	0% (0)	0% (0)	10% (1)	0% (0)

9. In order to make research more accessible and accelerate implementation of results, please rate the following internal communication strategies.

Communication Strategies	Priority	Transportation Areas			
		Research & Innovation	Maintenance	Traffic Operations	Project Implementation
Direct one-on-one contact with researchers	Low	0% (0)	0% (0)	10% (1)	0% (0)
	Medium	40% (2)	33% (2)	20% (2)	0% (0)
	High	60% (3)	68% (4)	60% (6)	100% (4)
	No Opinion	0% (0)	0% (0)	10% (1)	0% (0)
Raw research data provided directly from a researcher	Low	40% (2)	50% (3)	50% (5)	25% (1)
	Medium	60% (3)	33% (2)	20% (2)	50% (2)
	High	0% (0)	17% (1)	20% (2)	25% (1)
	No Opinion	0% (0)	0% (0)	10% (1)	0% (0)
Access to databases that contain raw research data	Low	0% (0)	0% (0)	20% (2)	0% (0)
	Medium	80% (4)	68% (4)	40% (4)	50% (2)
	High	20% (1)	33% (2)	30% (3)	50% (2)
	No Opinion	0% (0)	0% (0)	10% (1)	0% (0)
Summarized data that has been interpreted by the researcher that collected the data	Low	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	60% (3)	50% (3)	50% (5)	50% (2)
	High	40% (2)	50% (3)	50% (5)	50% (2)
	No Opinion	0% (0)	0% (0)	0% (0)	0% (0)
Research results interpreted by individuals within your organization or another third party	Low	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	60% (3)	50% (3)	50% (5)	25% (1)
	High	40% (2)	50% (3)	50% (5)	75% (3)
	No Opinion	0% (0)	0% (0)	0% (0)	0% (0)
Inventory of current research conducted throughout Caltrans including the names of the individuals conducting the research and project descriptions	Low	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	20% (1)	17% (1)	20% (2)	25% (1)
	High	80% (4)	83% (5)	70% (7)	75% (3)
	No Opinion	0% (0)	0% (0)	10% (1)	0% (0)
Regional meetings (Western States Forum) where researchers are presenting results of their work	Low	0% (0)	0% (0)	0% (0)	0% (0)
	Medium	20% (1)	33% (2)	30% (3)	0% (0)
	High	80% (4)	68% (4)	70% (7)	100% (4)
	No Opinion	0% (0)	0% (0)	0% (0)	0% (0)

10. What role do you and/or your district want to play with regard to research projects?

Types of Role	Transportation Areas			
	Research & Innovation	**Maintenance**	**Traffic Operations**	**Project Implementation**
Host research project (To provide logistical support, monitor project activities, review results, fully implement the project)	60% (3)	68% (4)	60% (6)	100% (4)
Provide resources (To provide financial, human and technical resources)	100% (5)	83% (5)	70% (7)	100% (4)
Be a partner with another district's research efforts	80% (4)	100% (6)	90% (9)	100% (4)
No participation	0% (0)	0% (0)	0% (0)	0% (0)

APPENDIX C: 38 SRQS AND SURVEY RESULTS COMPARISON

38 SRQs	Survey Results		
	Area	**Research Priorities**	**Time**
<u>Strategic Research Priorities:</u> RDSC approved the following nine Strategic Research Questions (SRQs) as Strategic Research Priorities for Fiscal Year (FY) 08/09 funding: • M1 DATA - How can we improve/enhance data collection and interpretation across modes? • M2 INTEGRATED CORRIDOR MANAGEMENT - How can we optimize movement through a corridor? • M5 TRAVEL DEMAND MANAGEMENT (REAL-TIME) - What are the most effective real-time strategies to influence travel demand? • M6 TRAVEL DEMAND MANAGEMENT (SYSTEM ELEMENTS) - What transportation system elements and land use options are most effective in reducing travel demand by enhancing choices? • M8 GOODS MOVEMENT - How can we improve goods movement throughout the State to generate jobs, increase mobility and relieve traffic congestion, improve air quality and protect public health, enhance public and port safety and improve California's quality of life? • SF1 DESIGN/CONSTRUCTION - What design features and construction standards can be utilized to improve highway safety? • SF4 PROACTIVE SAFETY - What can Caltrans do to mitigate collisions? • ST6 CLIMATE CHANGE - How can Strategic Growth Planning be advanced through addressing climate change adaptations and mitigations? • ST9 TRANSPORTATION INFRASTRUCTURE (e.g. Pavement, Structures, Maintenance Stations, Office Buildings, and others not listed) - How can we optimize the performance of our transportation infrastructure?	**Rural Safety**	• Proactive Safety 2 & 3 Lane Program • Accelerated Deployment of Innovative Traffic Safety Devices • Intersection Monitoring Program at Left Turn Pockets	**Short Range**
	Corridor Management	• Active Traffic Management	
	Weather System	• Ice detection and warning system	
	Incident Management	• Incident Management • Responder • Transportation Management Systems geared towards Rural Incident Management • Wildlife detection and warning system • Identifying High Collision Concentration Locations	
	Data	• Statewide consistency in TMC operations • EMS CONTROL APPLICATION • Data capture at TMC facilities	
	Rural Communication System	• Rural ITS Communications • Rural ITS warning systems • Motorist information • SafeTrip-21; short • Model 500, 510, 520 CMS Replacements	
	Capacity Building	• Employee Safety • Worker Safety	
	Rural Safety	• Improving Safety	**Short/Medium Range**
	Pavements	• Improving winter operations	
	Corridor Management	• Improving transportation system reliability	
	Weather System	• Improving meteorological data use for maintenance decision support	
	Rural Communication System	• Rural communications systems	
	Capacity Building	• Effective professional capacity building in technology areas	

<u>Best Practices:</u> RDSC approved the following 15 SRQs for Preliminary Investigations to identify Best Practices: • M3 INCIDENT MANAGEMENT - How can we manage incidents to reduce effects on traffic and improve system reliability? • M4 ACTIVE TRAFFIC MANAGEMENT - What are the most effective ways to manage vehicles on the roadway? • M9 SUSTAINABLE TRANSPORTATION AND COMMUNITIES - How can we integrate the transportation system into the community so society benefits? • SF3 WORKER SAFETY - What tools, technologies, and policies should be researched and implemented to improve administrative and engineering safety controls in the work environment? • SF5 REACTIVE SAFETY - What can Caltrans do once collisions occur? • SF6 DRIVER BEHAVIOR - How can we influence/educate drivers to operate their vehicles more safely? • ST2 LIFECYCLE BUDGETING FOR INFRASTRUCTURE - How can we better measure the impact of asset decisions on Caltrans finances? • ST3 LIFECYCLE COSTS - How can we incorporate lifecycle cost analysis into decision-making? • ST5 NATURAL AND PHYSICAL ENVIRONMENT - What can we do to reduce impacts to the natural and physical environment? • ST7 ASSET MANAGEMENT - How can we improve corporate inventory of assets and information (from structures to salamanders)? • SV3 INNOVATION - How can Caltrans foster innovation and risk-taking? • SV4 EMPLOYEE RETENTION - What are the most effective strategies to attract, select, and retain employees? • SV6 TOOLS - What tools are needed to properly perform each job in Caltrans? • D4 PURPOSE AND NEED - How can we establish and meet the purpose and need of the project throughout the project development process? • D6 ENGINEERING ESTIMATES - How can Caltrans improve the accuracy of capital cost estimates?	**Rural Safety**	• Coordinating the Department's Safety Program with the new Federal Traffic Safety Manual • Automated Speed Enforcement • Improve intersection safety • Automated or Augmented Speed Enforcement	**Medium Range**
	Pavements	• Recycled Pavements • Winter Operations • Effective paving materials that reduce ice and snow accumulation	
	Corridor Management	• Travel times & detours • Corridor Management • Low cost corridor modeling on rural routes with combination at grade and grade separated intersections • Evaluation of demand management strategies in a rural setting • Best practices used around the state in all rural districts • Incorporating low cost demand management strategies in the transportation system	
	Weather System	• RWIS MAINTENANCE AND CALIBRATION AND COST REDUCTION • Traveler information of highway conditions • Weather Systems	
	Human Factor	• IntellDrive • Driving distractions • Impaired driving	
	Incident Management	• incident detection	
	Data	• Methodology for Future Traffic Safety Data Collection and Supporting Database Structure • Data resources for TMC operations / Emergency operations • Low cost data communication methods from rural TMS to transportation centers	
	Rural Communication System	• Solar design guidelines for ITS equipment, similar to Sandia Labs design handbooks • Interoperability between TMCs	
	Capacity Building	• Staff development at TMCs	

<u>Low Priority:</u> RDSC identified the following 14 SRQ as Low Priority for FY 08/09 funding: • M7 STSTEM DESIGN - How do we design State highway facilities to maximize movement of people and goods? • SF2 ORGANIZATIONAL/INSTITUTIONAL - What organizational and institutional changes lead to improved safety? • D1 SCHEDULE - How can we set and meet realistically aggressive schedules? • D2 PROJECT MANAGEMENT - How can we effectively and efficiently manage delivery throughout the life of projects? • D3 PRIORITIZATION AND SELECTION - How can we prioritize projects so the most needed projects are delivered with the available resources? • D5 QUALITY - How do we ensure that the quality level of project deliverables match the purpose and need of the project? • D7 CAPITAL COST - How can we get the best value from capital dollars? • D8 CAPITAL SUPPORT COSTS - How can we use support resources most efficiently? • SV1 TRAINING - What competencies are not adequately addressed by existing training and how might these competencies be developed? • SV2 COMMUNICATION - What are the most effective ways to improve communication between Caltrans management and employees? • SV5 QUALITY SERVICE - What skills are necessary to develop an excellent workforce that provides quality service? • ST1 FINANCIAL FLEXIBILITY - How can State funding be used more flexibly to meet performance-based needs? • ST4 CULTURAL RESOURCES - How can we better manage our cultural resources? • ST8 EXCESS PROPERTY MANAGEMENT - How can we better approach asset management and excess land disposal in a business-like manner?	**Pavements**	• Improve asphalt pavement performance in cold weather areas	**Long Range**
	Corridor Management	• Congestion Management • Evaluation of effective Bus Rapid Transit options in a rural setting	
	Weather System	• Designing an open source / mixed vendor / component RWIS system	
	Human Factor	• IntelliDrive Implementation	
	Incident Management	• Minimize consequences of run off the road accidents	
	Rural Communication System	• Effectiveness of signs in communicating information to drivers on rural high speed roads • Improving traveler pre-trip planning	
	Rural Safety	• Rural Highway Safety Improvements	**On Going**
	Corridor Management	• State Highways as Main Streets	
	Rural Communication System	• Communications challenges TMC to field and TMC to TMC	