Stage 1 Business Analysis

1.1 General Information

Agency or State Entity Name:
Transportation, Department of

Organization Code:
2660

Proposal Name:
Transportation System Network Replacement / TSNR

Proposal Description:
Caltrans proposes to implement a new Transportation System Network (TSN) solution that integrates geospatial information required by MAP-21 and the FAST Act and addresses current system performance deficiencies.

Proposed Start Date: **January, 2019**

Delegated Cost Threshold (Optional): ⦿ Over ◯ Under

Department of Technology Project Number: 2660-545

1.2 Submittal Information

Contact Information:

Contact First Name: | **Contact Last Name:**
Karen | Olson

Contact Email: | **Contact Phone Number:**
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Submission Date:
12/22/2018

Submission Type:

⦿ New Submission   ◯ Updated Submission (Pre-Approval)

◯ Updated Submission (Post-Approval)   ◯ Withdraw Submission

Project Approval Executive Transmittal: 📎 File Attachment

1.3 Preliminary Assessment

1.3.1 Reportability Assessment

	Yes	No
1. Does the Agency/state entity anticipate requesting a budget action to support this proposal?	●	○
2. Does the Agency/state entity anticipate the estimated total development and acquisition cost to exceed the Department of Technology's established Agency/state entity delegated cost threshold **and** the proposal does not meet the criteria of a desktop and mobile computing commodity expenditure?	●	○
3. Does this proposal involve a new system development or acquisition specifically required by legislative mandate **or** is subject to special legislative reporting or review as specified in budget control language or other legislation?	○	●

Anticipated Reportability

Is this proposal anticipated to be reportable?	●	○

Planned Reporting Exemption

Does the Agency/state entity anticipate seeking an exemption from project reporting? (Answer only if Anticipated Reportability above is "Yes.")	○	●

1.3.2 Impact Assessment

	Yes	No
1. Has the funding source(s) been identified for this proposal?	○	●

If "Yes," select applicable funding source(s) and enter the fund availability date. If funding source is "Other Funds," specify below:

	FUND SOURCE Mark all that apply	FUND AVAILABILITY DATE
	☐ General Fund	
	☐ Special Fund	
	☐ Federal Fund	
	☐ Reimbursements	
	☐ Bond Fund	
	☐ Other Funds	

	Yes	No
2. Will the State possibly incur a financial sanction or penalty if this proposal is not implemented? If "Yes," provide details in Section 1.9 Business Problem or Opportunity Summary.	●	○
3. Is this proposal anticipated to have high public visibility? If "Yes," provide details in Section 1.9 Business Problem or Opportunity Summary.	○	●

4. On a scale of 1 to 3 (1 = None, 2 = Partially, 3 = Fully), indicate how well the current business processes are documented, communicated and available for review.   2

1.4 Business Sponsor and Key Stakeholders

Executive Sponsors

Title	First Name	Last Name	Business Program Area
Deputy Director	Socorro	Briseño	Planning and Modal Programs
Division Chief	James	Appleton	Division of Research, Innovation, and System Information

Business Owners

Title	First Name	Last Name	Business Program Area
Division Chief	James	Appleton	Division of Research, Innovation, and System Information
Office Chief	Mandy	Chu	Office of Highway System Information and Performance
Branch Chief	Brian	Domsic	Traffic Accident Surveillance and Analysis System Branch

Key Stakeholders

Title	First Name	Last Name	Business Program Area/Group	External
Geospatial Data Officer	Chad	Baker	Geospatial Data Officer	☐
Office Chief	Mandy	Chu	Office of Data Services & Technology (Acting)	☐
Branch Chief	Gerald	Schumacher	GIS Linear Referencing Services Branch	☐
Division Chief	Jesse	Bhulllar	Division of Traffic Operations	☐
Office Chief	Thomas	Schriber	Office of Performance	☐
Office Chief	Duper	Tong	Office of Traffic Engineering	☐
Office Chief	David	Ly	Office of Operations and Resources Management	☐
Assistant Division Chief	Lauren	Machado	Legal	☐
Data Processing Manager	Chitra	Chitturi	Office of Business Applications Maintenance & Support	☐
Division Chief	Tony	Tavares	Division of Maintenance	☐
Office Chief	Ferdinand	Milanes	Office of Roadway Maintenance	☐
Office Chief	Zhongren	Wang	Office of Pavement Management and Performance	☐
Division Chief	Ray	Zhang	Division of Local Assistance	☐
Division Chief	Chris	Schmidt	Division of Transportation Planning	☐
Division Chief	Timothy	Craggs	Division of Design	☐
Commander of Support Services	Isaac	Tillman	California Highway Patrol	☐

| | | | Local Agencies | ☑ |
| | | | District Highway Safety Offices | ☐ |

1.5 Business Driver(s)   Mark all that apply

Financial Benefit:
☐ Increased Revenues
☐ Cost Savings
☐ Cost Avoidance
☐ Cost Recovery

Mandate(s):
☐ State
☑ Federal

Improvement:
☑ Better Services to Citizens
☑ Efficiencies to Program Operations
☑ Improved Health and/or Human Safety
☑ Technology Refresh

Security:
☐ Improved Information Security
☐ Improved Business Continuity
☐ Improved Technology Recovery

1.6 Statutes or Legislation

Statutes or Legislation:
◉ New Statutes
○ Potential Legislation
○ Changes to Existing Legislation
○ Not Applicable

Bill Number: H.R 4348 - 112th Congress: MAP-21

Legal Reference: **Public Law 112-141**

Additional Information:

1.7 Program Background and Context

System Description
The Transportation System Network (TSN) is an enterprise Oracle application shared across Caltrans and maintained by the Traffic Accident Surveillance and Analysis System (TASAS) Branch. The database includes the highway inventory for all State highway facilities in California, which consists of more than 15,000 centerline miles of highways, 15,114 ramps, and 17,137 intersections. The data is used to generate quarterly and annual reports identifying highway locations for federal reporting and legal investigation. These reports also provide valuable data that helps the Department achieve its goals in reducing the number and severity of traffic collisions by ensuring that opportunities to improve highway safety are identified, considered, evaluated and implemented in all phases of highway planning and operation.

Impacted Program Areas – Users and Stakeholders
The business program areas and groups that will be impacted by this solution include the following:

1. The Division of Research, Innovation and System Information (DRISI) consists of the Research and System Information (SI) groups. The SI staff collect, analyze, and report data related to the State's roadway systems. Research carried out through the Research group is used by SI to improve its ongoing work. A number of program areas and groups within SI will be impacted by this effort. These include the following Offices:

   a. Office of Highway System Information and Performance (OHSIP) – manages work associated with the Highway Performance Monitoring System (HPMS) and TASAS. Significant parts of the mission of the office are impacted by this effort. The major functions of OHSIP include:

      - Administer public roads' functional classification and designation approvals to secure and distribute state and federal funding.
      - Manage the naming of State roadways, structures, and appurtenances.
      - Partner with federal and local agencies, manage urban and rural area designations and maintain the official California Road System (CRS) map set.
      - Collect and manage condition and performance data in the federally mandated HPMS and officially certify the annual report on maintained public roads in California.
      - Support performance-based decision making by exercising leadership in implementing Transportation System Performance Measures at the national, state, and regional levels.

      The following branches and associated systems within OHSIP utilize data within TSN:

      - TASAS Branch: manages TSN and maintains the Highway Inventory data and Collision Rate Reports within TSN.
      - HPMS Branch: manages the processing and delivery of the HPMS federally mandated Inventory and Planning reports to the Federal Highway Administration (FHWA).

   b. Office of Data Services and Technology (ODST) – manages work associated with Geospatial Information Systems (GIS), Project Delivery Assets, and Research Deployment. ODST manages the All Roads Linear Referencing System (LRS) for Caltrans. The LRS has an integral, complex relationship with TSN; data from TSN is currently used by the LRS. The future evolution of the relationship between the Highway Inventory within TSN and the LRS is a major part of this project.

   c. Office of Operations and Resources Management – this office includes the Traffic Collision Reports Coding Branch which manages the entry of collision data within TSN. The relationship between California Highway Patrol (CHP) systems that provide collision reports and their use within TSN will heavily impact the work of the Collision Reports Coding Branch.

2. The Office of Performance within the Division of Traffic Operations is a major producer and consumer of TSN data. Enhancements to TSN will impact a number of the core functions of the Office including:

   - Leading participation in the Strategic Highway Safety Plan (SHSP).
   - Managing the Highway Safety and Operations Improvement Program.
   - Coordinating asset management.
   - Conducting monitoring and analysis of traffic data.
   - Collecting and disseminating traffic data.
   - Leading MIRE safety data collection effort.

   TSN is used for storing, maintaining, and reporting of the integrated datasets of Highway Inventory, Traffic and Collisions. The Division is a major provider of Traffic data to TSN as well as a user of the integrated datasets for safety and operations improvements as well as asset management. Within the Office, multiple branches handle various data that is impacted by TSN as follows:

- Monitoring and Analysis Branch: manages Performance Measurement System (PeMS) which holds traffic data from sensors on roadways. The branch manages the rollout of Safety Analyst (a software for collision and improvements analysis) and the development and update of safety performance functions, which would be relevant for future required analysis under MAP-21. The branch generates TSN reports to produce lists of locations for Traffic Investigations.

- Traffic Data Branch: enters data into TSN that is later utilized by PeMS to produce Traffic Census and Truck Counts.

- Asset Management Branch: documents traffic assets via Photo log and Inventory and could be an additional source of highway inventory data for TSN in the future.

- Highway Safety and Operations Improvement Program: uses TSN data to help provide oversight and approval for safety projects.

- Highway Safety Branch: uses data from TSN to produce the Highway Safety Improvement Program (HSIP) Report and supports the Strategic Highway Safety Plan (SHSP) committees for Caltrans.

3. The Division of Maintenance, responsible for maintenance of the state highway system, uses Roadway Inventory and Traffic data from TSN.

4. The Legal Division litigates for Caltrans tort claims. Caltrans attorneys use TSN data to develop support for evidence and testimony for trial preparation.

5. Traffic Engineering Office conducts safety analysis to reduce the number and severity of collisions on the State Highway System (SHS). The TSN collision and inventory data is used to identify the state highways that have high collision rates.

Existing System Interfaces and Integrations
In addition to its collision analysis capabilities, TSN also exchanges data with and provides data to several Caltrans systems. The Highway Performance Monitoring System (HPMS) is the major federal reporting system for Caltrans. The TSN is the system of record for State-owned highways federal reporting of Highway Inventory and Traffic data, and as such, HPMS is wholly dependent on TSN for this data. The LRS uses GIS data which is also a federal HPMS reporting requirement. The LRS uses post-mile information from TSN as a critical input in the creation of this dataset for federal reporting and other uses. The TSN imports traffic inventory data from PeMS and provides PeMS with highway inventory information. The TSN provides the Pavement Management program as well as a number of other systems with traffic and roadway inventory data.

1.8 Strategic Business Alignment

Strategic Business Goals	Alignment
Caltrans Strategic Management Plan 2015-2020 **Strategic Goal 1: Safety and Health** Provide a safe transportation system for workers and users, and promote health through active transportation and reduced pollution in communities.	The proposed project is in alignment with the Department's strategic objective to "Reduce user fatalities and injuries by adopting a 'Toward Zero Deaths' practice and 'Zero worker fatalities,'" as reports derived from the TSN system are used to make decisions on projects that will save lives on roadways. One of the metrics to be used to determine the success of this strategic goal is the reduction in the number of fatalities for bicycle, pedestrian, and transit modes of travel.
Caltrans Strategic Management Plan Sustainability, Livability and Economy Plan	The proposed project is in alignment with the Department's strategic objective of providing a mobility choice and

2015-2020 **Strategic Goal 3:** Improve the quality of life for all Californians by providing mobility choice, increasing accessibility to all modes of transportation and creating transportation corridors not only for conveyance of people, goods, and services, but also as livable public spaces.	increasing accessibility to all modes of transportation. The metric used by this objective is the percentage increase of non-auto modes of transportation (bicycle, pedestrian and transit). Improving TSN would enable the ability to track success through greater detail on collision locations, as well as provide the data necessary to determine when and where to improve bike and pedestrian routes.
Caltrans Strategic Management Plan 2015-2020 **Strategic Goal 4:** System Performance Utilize leadership, collaboration, and strategic partnerships to develop an integrated transportation system that provides reliable and accessible mobility for travelers.	The proposed project will improve the ability to provide reliable information and reduce dependency on manual effort, thereby aligning with the Department's strategic objective to improve integration and operation of the transportation system.
Strategic Plan Last Updated	7/10/2017

1.9 Business Problem or Opportunity Summary

The following problems are driving the need for improvements in the processes and data needs of the Transportation System Network.

Inability to Meet Federal Mandates
The Federal Statute, Moving Ahead for Progress in the 21st Century Act (MAP-21), is a major driver behind this effort. MAP-21 (Pub. L. 112-141, 126 Stat. 405) was signed into law July 6, 2012. This federal regulation requires states to have a safety data system in place that can be used to analyze supporting strategic and performance goals. This law also requires states to use their safety data systems to identify fatalities and serious injuries on all public roads by location, and specifies that states have the capability to link collision, roadway, and traffic data by geolocation. The current TSN is not able to comply with the reporting requirements as outlined in MAP-21. Caltrans must bring itself into compliance with MAP-21 requirements.

While MAP-21 was signed into law in 2012, the publishing of rules in the Federal Register occurred in 2016. During this period, a number of different interpretations could be ascribed to the legislation and its intent. The final rules make the legislative impact of the mandate unambiguous. On April 22, 2016, FHWA posted a Notice of Proposed Rulemaking (NPRM) in the Federal Register to propose national performance management measure regulations to assess the performance of the National Highway System, Freight Movement on the Interstate System, and the Congestion Mitigation and Air Quality Improvement Program, as required by the MAP-21 and the Fixing America's Surface Transportation Act (H.R 22-114th Congress: FAST Act). On May 27, 2016, the U.S. Department of Transportation's (USDOT) FHWA and Federal Transit Administration (FTA) published the Final Rule on Statewide and Nonmetropolitan Transportation Planning and Metropolitan Transportation Planning in the Federal Register to implement the changes to the planning process established by MAP-21 and the FAST Act. On October 24, 2016, FHWA published a Final Rule on Asset Management Plans in the Federal Register to address requirements established by MAP-21 and the FAST Act. Additional details about the rules of this Act can be found at: https://www.fhwa.dot.gov/tpm/rule.cfm.

State Departments of Transportation (DOTs) will now be required to establish performance targets and assess performance in twelve areas established by the MAP-21, and FHWA will assess their progress toward meeting targets in ten of these areas. State DOTs that fail to meet or make significant progress toward meeting safety targets will be required to direct a portion of their HSIP funding toward projects that will improve safety. In addition, this rule establishes 1) the process for State DOTs and Metropolitan Planning Organizations (MPOs) to use to establish and report their safety targets, 2) the process for State DOTs and MPOs to report on their progress for their safety targets, and 3) the process that FHWA will use to assess whether State DOTs have met or made significant progress toward meeting safety targets. The level of detail required is substantial. One example is roadway data; the Highway Safety Improvement Program (HSIP) rule requires states to collect and

use a subset of the Model Inventory of Roadway Elements (MIRE) for all public roadways, including local roads. These data elements will improve States' and MPOs' ability to estimate the expected number of collisions at roadway locations. MIRE contains data items related to roadway characteristics that are important in safety analysis, such as intersection type. Of importance in the description above is the fact that the FHWA has not only specified the outcomes (safety performance targets) to be achieved but also the datasets that must be obtained, as well as the type of analysis that must be performed. This is a specification of minimum requirements.

States will set targets for the number of serious injuries and fatalities per vehicle mile of travel. If a state fails to make progress toward its safety targets, it will have to devote a certain portion of its formula obligation limitation to the safety program and submit an annual implementation plan on how the State will make progress to meet performance targets. Additionally, if the necessary data is not available or accessible for the State to be able to perform analysis and create reports, the State will be in danger of not conforming to the mandated requirements.

Sanctions and penalties related to funding are described as limitations and included in Federal Transportation code 23 U.S.C. 148. "If a State does not have an updated strategic highway safety plan with a process approved by the Secretary by August 1 of the fiscal year beginning after the date of establishment of the requirements, the State shall not be eligible to receive any additional limitation pursuant to the redistribution of the limitation on obligations for Federal-aid highway and highway safety construction programs that occurs after August 1 for each succeeding fiscal year until the fiscal year during which the plan is approved."

The federal mandates described above cannot be met with the existing Transportation System Network. The TSN's noncompliance with Federal mandates was identified through interviews, informational meetings and document reviews with project stakeholders who currently use the TSN. The following have been identified as the objectives that must be met to comply with the federal mandates:

1. Implement a safety data solution that can identify fatalities and serious injuries by geolocation.
2. Implement a safety data solution that retains temporal and historical data, so reports can be created that can identify at a point in time what the characteristics of the roadway are.
3. Implement a safety data solution that can identify fatalities and serious injuries on all state and local roads.
4. Implement a safety data solution that will report on FHWA's MIRE subset that directly supports HSIP implementation efforts, with the ability to accommodate future MIRE requirements.

Inefficiencies in Current Program Operations
Program inefficiencies resulting from TSN limitations were identified through interviews, informational meetings and document review. The following issues cause inefficiencies in current program operations:

1. No Geolocation: Because the current TSN does not report by geolocation, Caltrans is forced to use a resource-intensive manual process to enable the data collection and mapping to a post mile marker. California uses a post mile highway location marker system on all of its state highways, including U.S. Routes and Interstate Highways.
2. Obsolete User Interface: The system is based on an outdated version of Oracle Forms. The system deficiencies make it difficult to retrieve data in the format required for Legal investigation and federal regulatory reporting.
3. No External Agency Capability: The system is unable to support efficient collaboration with local agencies to identify fatalities and collisions. It cannot interact with other safety data systems. This is a crucial requirement of the federal mandates since the law now covers all public roads, not just state-owned highways.
4. No Ad-hoc Reporting Capability: Running reports is difficult and time consuming. In order to meet changing reporting needs, information is retrieved from the system and ported to Excel or Word for additional analysis and formatting.
5. Not a Centralized System of Record for Data: The TSN is not a centralized database and fails to meet the standards for a system of record. There is no clear path from source(s); sometimes the data is separated

from original sources of data (for example raw data is delivered and analyzed then only the end result is uploaded and stored). This process makes it impossible to validate the analysis, and severely impacts the level of data reliability. For external consumers of the data, it is especially important to have access to data sources and the complete history of the documentation and its versions. Additionally, without a centralized database, information can become isolated and have reduced exposure to users who depend on this critical information.

6. Inability to Meet Safety Analysis Requirements: The system cannot carry out the new safety analysis requirements based on the MIRE subset of data identified by the FHWA; it continues to use older calculation methods.

7. Inefficient Traffic Data Exchange: The data exchanges with the PeMS are manual and prone to error since the data is not geospatially enabled and does not work off the same location reference. Additionally, the traffic data exchange does not use modern communication modes to link distributed systems (e.g. web services or other modern standardized data exchange mechanisms).

8. Inefficient Traffic Data Exchange: The data exchanges with the California Highway Patrol's system for retrieving Collision Reports is manual and is error prone because the data is not geospatially enabled and does not work off the same location reference.

9. Inefficient Linear Referencing Data Exchange: The data exchanges with the Data Service Technology group (GIS) for getting Inventory data are manual since the data is not geospatially enabled. A tight integration between Inventory and GIS is necessary for smooth operation.

10. Lacking Bike and Pedestrian Data: The system is not designed to host inventory, traffic, collision and safety data for bikes and pedestrians. This is a requirement of MAP-21.

11. Slow Updates – Data not Timely: Because of all the data errors and manual data exchanges and updates, updates can fall behind by significant periods. Traffic and collision data processing is behind by multiple years; LRS data processing is behind by one year.

12. Complex System Governance: Because of the severe functional limitations of TSN, a number of work-arounds have been developed, including redundant data storage to make it easily accessible and available outside TSN. Besides being highly inefficient, this process leads to data integrity issues since many sources for similar data are available to users.

Technology Refresh

Caltrans' current TSN Oracle database and the application server is nearing obsolescence. The current graphical user interface (GUI) is based on Oracle Forms 10G. Oracle Reports 10g, shipped in 2005, was its last feature bearing release. Only minor functional enhancements have been done in the last 10 years. Since TSN implementation, new tables and customized reports have not been created. Oracle has recommended a migration to Oracle Business Intelligence Publisher to address the issues found in the older Oracle Forms application. A solution with updated technology would provide increased sustainability, allowing the system to integrate with other systems using current communication methods.

1.10 Business Problem or Opportunity and Objectives Table

ID Problems or Opportunities

1   TSN currently doesn't collect safety and collision data on local roads and it also lacks the functional ability to provide temporal and historical data and specific geolocation on all public roads as required by MAP-21, FAST Act and other federal requirements, resulting in an inability to meet all the federal collaboration requirements.

Obj # Objective

1.1   Implement a safety data solution that provides geolocation functionality to identify locations on state and local roads where fatalities and serious injuries have occurred.

Metric	Baseline	Target	Measurement Method
Percentage of locations for	None	Within a year of	Run a report on all collisions and

collisions and fatalities that can be identified by geolocation within the safety data system.	full implementation, 100% of collisions and fatalities will be located using geolocation.	fatalities experienced within a one-year period. Verify all reported collisions have geolocation data.

Obj #   Objective

1.2   Implement a safety data system that stores temporal and historical safety data so reports can be created that identify the characteristics of the roadway at a specific point in time.

Metric	Baseline	Target	Measurement Method
Percentage of collision and fatality records with temporal and historic roadway characteristics data.	None	Within a year of full implementation, 100% of all roadway inventory data contains both historical (current year plus 10 prior years) and temporal information.	Run a tracking report containing roadway inventory which includes temporal and historic data (current year plus 10 prior years) to validate inclusion.

Obj #   Objective

1.3   Implement a safety data system that collects data and reports on the subset elements to meet the MIRE requirement.

Metric	Baseline	Target	Measurement Method
Number of elements from the MIRE that the safety data system can report on.	None	Within a year of full implementation, able to report on MIRE requirements	Validate the ability to create a report that meets the MIRE requirements.

ID Problems or Opportunities

2   Efficiencies to Program Operations: TSN has no external agency integration capability. Although regulatory requirements mandate this, the system is unable to collaborate efficiently with local agencies to identify fatalities and collisions. It cannot interact with other external safety data systems. This is a crucial requirement of the new federal mandates since they now cover all public roads, not just state owned highways. As a result of not having this integration capability, Caltrans staff are required to use work-arounds in order to collaborate with other agencies.

Obj #   Objective

2.1   Provide a software solution that includes an application programming interface (API) and security features that allow TSN to collaborate with external agencies.

Metric	Baseline	Target	Measurement Method
Number of external agencies having access.	None	Within one year of implementation,	Setup a test data exchange with a selected external partner, record the actual data exchange and check inputs

| | | at least one external agency has access through the API. | and outputs. | |

ID Problems or Opportunities

3   Efficiencies to Program Operations: TSN has no ad-hoc reporting capability, and technology limitations of the current system prevent addition of this functionality. Generating the existing reports is time consuming and difficult. As user reporting requirements evolve over time, existing canned reports have become obsolete, resulting in unmet reporting needs.

Obj #	Objective
3.1	Provide a solution that reduces the time and manual effort of TSN reporting by providing ad-hoc reporting capability that has the ability to export results into standard formats (CSV, Excel).

Metric	Baseline	Target	Measurement Method
Availability of user configurable ad-hoc reporting capability.	Not available.	At full implementation, users are able to create reports based on their own requirements.	Produce ad-hoc reports to test the functionality exists.

ID Problems or Opportunities

4   Efficiencies to Program Operations: TSN does not have a centralized system of record for data nor is the data available electronically to authorized users across the state, resulting in the need for manual work-arounds. Units located across California cannot easily collaborate, resulting in data redundancy and loss of data integrity.

Obj #	Objective
4.1	Provide a solution that provides access to current, up-to-date data with access across the Department.

Metric	Baseline	Target	Measurement Method
Existence of web-based access across the Department.	Not available.	Within one year of full implementation, users have web-based access across the Department.	Validate that users have web-based access to data.

Obj #	Objective
4.2	Provide a solution that stores and maintains a centralized repository of Inventory, Traffic and Collision data.

Metric	Baseline	Target	Measurement Method
A centralized repository of critical inventory, traffic and collision records.	Not available.	Within five years of full implementation, all critical	Observe and verify the data dictionary for critical data on inventory, traffic and collisions. Ensure the critical tables are fully populated in the database.

inventory, traffic and collision records are in the system and being maintained.

Obj #	Objective
4.3	Provide a solution that reduces the need for work-arounds and manual effort, thereby improving data integrity and simplifying the governance processes.

Metric	Baseline	Target	Measurement Method
Existence of automated data integration protocols.	Not available.	Within one year of implementation, data integration between systems is an automated process.	Report on the methods data is input and output.

ID Problems or Opportunities

5	Efficiencies to Program Operations/Human Safety: TSN does not have the required new safety analysis functionality. Because it uses the older calculation algorithms and functionality, TSN is not capable of calculating the new safety analysis requirements based on the MIRE subset of data identified by FHWA. As a result, Caltrans is not federally compliant based on FHWA requirements and is at risk of federal sanction.

Obj #	Objective
5.1	Provide a solution that incorporates updated safety analysis such that both the existing and the new methods and algorithms are met.

Metric	Baseline	Target	Measurement Method
Ability to produce reports based on safety analysis specifications using existing and new methods.	Not available.	Within one year of full implementation, system is producing existing analysis. Within two years of implementation, the system is producing new analysis reports.	Check system output reports for the type of analysis being produced.

ID Problems or Opportunities

6	Efficiencies to Program Operations: Caltrans' TSN traffic data exchanges with the PeMS are manual and error prone because 1) the data is not geospatially enabled and does not work off the same location reference, and 2) they do not use modern communication modes to link distributed systems (e.g. web services or other modern standardized data exchange mechanisms). As a result, updates are slow and the Legal office cannot get up-to-date information required to assist in legal matters.

Obj #	Objective
6.1	Provide a solution that provides location referencing needs of PeMS.

Metric	Baseline	Target	Measurement Method
Ability to identify and provide location information required by the PeMS.	Not available.	Within two years of full implementation, location referencing needs of PeMS provided.	Publish a report of PeMS data that includes required location information.

ID Problems or Opportunities

7 Efficiencies to Program Operations/ Human Safety: Caltrans' TSN's data exchange with the California Highway Patrol's system for retrieving Collision Reports is manual and error prone because the data is not geospatially enabled and does not work off the same location reference.

Obj # Objective

7.1 Provide a solution that uses current system interfacing technologies with geospatially enabled component and standards based data exchanges to develop an interface with CHP's collision reporting systems for state and local roads.

Metric	Baseline	Target	Measurement Method
Existence of TSN interface with CHP's collision reporting systems meeting current technologies with automated data exchange abilities.	Not available	At full implementation, automated data exchange occurs between CHP's collision reporting systems and TN with limited manual intervention	Set up a test data exchange with CHP, record the actual data exchange and check inputs and outputs.

ID Problems or Opportunities

8 Efficiencies to Program Operations: Caltrans' TSN data extraction by the Data Service and Technology group (GIS) for getting inventory data is manual because the data does not include geospatial attributes. As a result of utilizing the manual process, data exchange is a time consuming process that leads to human errors.

Obj # Objective

8.1 Provide a solution that will fully integrate TSN post-mile system with the Department's implementation of Esri Roads and Highways Linear Referencing System

Metric	Baseline	Target	Measurement Method
TSN is constantly synchronized and continuously updated with the Department's Esri Roads and Highways Linear Referencing System.	Not available.	Within one year of full implementation, system is fully synchronized with the Department's Esri Roads and Highways Linear Referencing System for one	Compare an LRS report with an Inventory report from TSN and ensure the data maps. Test for discrepancies between the LRS and Road Inventory when critical updates to LRS happen.

district. Within five years of implementation, system is fully synchronized with the Department's Esri Roads and Highways Linear Referencing System on a statewide basis.

ID Problems or Opportunities

9   Efficiencies to Program Operations/Human Safety: TSN is not designed to host inventory, traffic, collision and safety data for bikes and pedestrians, resulting in TSN's inability to meet MAP-21 requirements and putting Caltrans at risk of federal sanctions.

Obj #	Objective
9.1	Provide a solution which cano host inventory, traffic, collision and safety data for bikes and pedestrians. This is a requirement of MAP-21.

Metric	Baseline	Target	Measurement Method
Existence of storage, update, analysis and reporting capability for bikes and pedestrians' data similar to vehicle/roadway capabilities of the system.	Not available.	Within one year of full implementation, system has storage, update, analysis and reporting capability for bike and pedestrian data for one district. Within five years of implementation, system has this capability on a statewide basis.	Produce reports of the pilot data for bikes and pedestrians. Check the reports for completeness of data. Produce reports of the statewide data for bikes and pedestrians. Check the reports for completeness of data.

ID Problems or Opportunities

10   Efficiencies to Program Operations/Human Safety:
The lack of a sound TSN data governance program has resulted in manual data update processes that require more resources and time to complete than it would take with an automated process.
The manual update process is error prone. To address these errors, additional validation is required, resulting in a backlog of up to two years before traffic and collision data is available for reporting in TSN, and backlogs in LRS updates also. This results in noncompliance with MAP-21 reporting requirements.

Obj #	Objective
10.1	Provide a solution which uses technology, workflows and governance mechanisms to reduce the backlog of data processing and updating.

Metric	Baseline	Target	Measurement Method

Size of traffic and collision data backlog.	Traffic and collision data processing has a two-year backlog.	One year after full implementation, all traffic and collision data is up to date.	Verify the size of the Traffic and Collision backlog.

ID Problems or Opportunities

11 Technology Refresh: TSN is based on Oracle technologies consisting of layers of components. Some of these components have not been meaningfully updated in over a decade, resulting in a system that is functionally obsolete and therefore, difficult for new staff to learn and use.

Obj #	Objective
11.1	Provide a solution that uses current technological standards that allows standard functionality and extensibility to meet future needs as they are encountered.

Metric	Baseline	Target	Measurement Method
System software version is based on database and application services technologies whose software version is within five years of current date.	0% of the system database and application services are within five years of current date.	100% of the system database and application services versions are within five years of current date.	Check vendor's documentation that the full platform composed of database and application server is within the vendor's premier support cycle and not merely within extended support.

1.11 Business and Stakeholder Capacity

1.11.1 Business Program Priorities

	Yes	No
Does this proposal share resources (state staff, vendors, consultants or financial) with other business program priorities within the Agency/state entity?	◉	○

Implementation of a new TSN solution is important to the Department so that commitments to comply with federal mandates can be fully and efficiently implemented. The selected Sponsorship will ensure that the correct personnel from multiple programs will participate when they are needed and for as long as they are needed, to ensure that the project maintains the level of commitment needed to complete it successfully. Sponsorship at this level of management will also facilitate the adoption of a new or updated TSN solution and future organizational change management plans so that the system will be used as intended and the complete benefits to the Department can be fully realized.

1.11.2 External Stakeholder Involvement

Local Agencies will be impacted by this proposal as collaboration tools are created and implemented. As these changes are made, instructions will be provided to local agencies and opportunities provided to participate in testing of these new functions. As necessary, California Highway Patrol will be involved during testing of the new system.

1.11.3 New or Changes to Business Processes

	Yes	No
Does the Agency/state anticipate this proposal will result in the creation of new business processes?	◉	○
Does the Agency/state entity anticipate changes to existing business process?	◉	○

This proposal will have a significant impact on Caltrans staff, including technological, procedural, and behavioral changes.

1.12 Organizational Readiness

1.12.1 Governance Structure

	Yes	No
Does the Agency/state entity have an established governance structure for combined business and IT decision making, including information security and privacy?	◉	○

Caltrans has established a collaborative governance model for technology that requires decision-making at the executive level. Divisions submit requests for new projects and initiatives and the IT Project Management Office reviews them and presents them for approval and prioritization. The IT Project Management Office leads concept refinement, requirements analysis, planning and execution of new IT projects, ensuring compliance with State IT project, procurement, and security policies. Business owners request changes, enhancements, and priorities within approved limits. This governance model helps the effective management of Caltrans' technology portfolio.

1.12.2 Leadership Participation

Identify the levels of leadership that are aware of and engaged in addressing the business problem(s)/opportunity(ies) identified in this proposal (check all that apply):

- ☑ Executive
- ☑ Senior Management Business/Program
- ☑ Mid-level Management Business/Program
- ☑ Senior Management IT
- ☑ Mid-level Management IT
- ☑ Enterprise Architect

The following briefly describes each level of leadership's involvement in the various phases of the proposed project:

- Executive. Caltrans' Executive Board initially develops Caltrans business priorities, which drive IT priorities, project approval, and funding. During project execution, the Executive Steering Committee (to be developed) will receive regular briefings on the IT portfolio and individual project highlights. Issues will be escalated to the Director level as needed. Additionally, the Deputy Director for the business program will serve as an executive sponsor and participate in the Executive Steering Committee.
- Senior Management Business/Program. The Chief of the Business Division serves as the business project sponsor. As part of the governance model, projects are only internally moved forward for consideration after the business division chief approves the business case. The Chief also serves on the Executive Steering Committee and is a key point in the escalation process. If multiple business divisions are involved, each chief is also involved.
- Mid-Level Management Business/Program. A mid-level manager from the business program will serve as the business project manager. Additionally, other mid-level managers from the business program may serve on the steering committee or be involved in business process reengineering, organizational change, etc. It is also expected that the mid-level managers will participate in identifying staff and subject matter experts who can support the project as project resources.
- Senior Management IT. A senior management member from IT will serve as the IT project sponsor. The IT project sponsor will work collaboratively with the business sponsor.
- Mid-Level Management IT. The IT Project Management Office will assign an IT project manager to the project. Additionally, managers within each of the IT Divisions will be involved in key decisions about the project, its architecture, etc. As needed, other IT managers will be briefed on the status of the project and involved as it relates to their specific discipline.
- The IT Infrastructure Division Chief / Enterprise Architect is involved in every IT project, as it relates to the project's specific infrastructure needs. While some duties may be delegated to technical staff, the Chief will participate in the initial project review and internal approval, to ensure its consistency with the department's overall IT direction, capabilities, and standards.

Preparing Leaders for their Role in the Project
To prepare the Project Sponsors (both business and IT) for their role in the project, Caltrans will review roles and responsibilities and the state process for IT projects. This will help educate the business sponsors and non-IT staff on key IT terminology, the general flow of an IT project, and how to engage with the vendor and IT staff. The goal of this effort is to also aid both the sponsors and other key business staff in understanding how their business decisions translate into technical decisions, and their resulting impact. The preparation activities will be tailored based on the final roles/responsibilities within the project structure.

Leadership Availability and Commitment
Caltrans leadership team and the Project Sponsors (both business and IT) are committed to this project. The Project Sponsors will work closely with the Project Managers, and attend and actively participate in regularly scheduled status and steering committee meetings. Since the Project Sponsors serve as a point of escalation, the sponsors are committed to expedite key decisions related to project issues or other concerns that prevent or slow progress.

Leadership Experience with Organizational Change Management
Caltrans leadership team and the Project Sponsors (both business and IT) are familiar with various aspects of Organizational Change Management (OCM), including business process documentation and/or reengineering, communication, change management, training, leadership alignment, etc. Caltrans anticipates contracting with a vendor for OCM support for this project effort.

1.12.3 Resource Capability/Skills/Knowledge for Stage 2 Alternatives Analysis   Yes   No

Does the Agency/state entity anticipate requesting additional resources, through a budget request, to further study this proposal and/or perform procurement analysis?   ⚪ ⦿

Of the Agency/state entity resources identified to perform Stage 2 Alternatives Analysis for this proposal, enter the number of staff who have had experience with planning projects of a similar nature.   2

In addition to Caltrans IT-PMO Business Analysis staff, business personnel with extensive Program knowledge and experience will be involved in the development of requirements and the determination of alternative and recommended solutions. IT Technical Support, Infrastructure, Network, and Security staff will provide technical expertise and the Division of Procurement and Contract staff with considerable Procurement experience will also participate in procurement of selected solution.

1.12.4 Training and Organizational Change Management   Yes   No

With respect to the magnitude of this proposal, does the Agency/state entity have resources, processes, and methodologies in place to provide training and organizational change management services?   ⦿ ⚪

Does this proposal affect business program staff located in multiple geographical locations? If "Yes," specify the city, state, number of locations and approximate staff in each location: ⦿ ⚪

City	State	Number of Locations	Approximate Number of Staff
Sacramento	California	1	303
Eureka	California	1	29
Redding	California	1	31
Marysville	California	1	135

Oakland	California	1	148
San Luis Obispo	California	1	41
Fresno	California	1	75
Los Angeles	California	1	172
San Bernardino	California	1	124
Bishop	California	1	16
Stockton	California	1	116
San Diego	California	1	97
Irvine	California	1	65

Caltrans' IT Leadership, Management, and the IT PMO understand the importance of training and OCM and intend to require an appropriate level of both on this project. Specifics of training and change management needs will be developed after solution analysis and selection. It is anticipated that the vendor, working with Caltrans staff, will provide these services. Resources will be budgeted within the proposed project to support these efforts.

1.12.5 Enterprise Architecture   Yes   No

Does the Agency/state entity have a documented target (or future state) enterprise architecture that provides the overall business and IT context for this proposal?   ◉   ○

As noted in section 1.12.1, Caltrans recently implemented an initial enterprise IT Governance Framework that focuses on project approval, enterprise architecture, standards, portfolio and project management, change control and other functions. As part of that framework, an Enterprise Architecture Committee (EAC) has been established. The EAC's mission includes defining EA standards, as well as documenting the as-is and future state enterprise architecture and developing a Five-Year Enterprise Architecture Technology Roadmap.

The TSNR has been identified as a system Caltrans replace on the five-year Enterprise Architecture Technology Roadmap.

A key goal of the EA effort at Caltrans has been to create an EA reference model that can aid in driving technology investment decisions. Caltrans recognizes the value of a defined and documented EA, particularly as it relates to normalizing EA and the downstream benefits to maintenance ease and cost, and employee skills. The EAC is currently working to define EA standards, processes, procedures, practices, tools, and other elements that will eventually be applied to the enterprise. Further, Caltrans is completing a statement of work (SOW) to enhance the five-year EA Technology Roadmap in FY 17/18.

1.12.6 Project Management

Project Management Risk Score: 0.9

1.12.7 Data Management   Yes   No

1. Does the Agency/state entity have an established data governance body with well-defined roles and responsibilities to support data governance activities?   ○   ◉

2. Does the Agency/state entity have data governance policies (e.g., data policies, data standards, etc.) formally defined, documented and implemented?   ○   ◉

3. Does the Agency/state entity have data security policies, standards, controls, and procedures   ○   ◉

formally defined, documented and implemented?

Currently, data governance is managed at the system level, rather than the data level. Caltrans' business programs/divisions have generally independent systems which are typically siloed and managed by the business area. Interfaces are often designed to share information needed to perform a transaction, but master data resides in the originating system; updates to data in downstream systems do not flow back to the originating master data. Storage, archival, back-up, and other procedures are often system-specific, based on when the system was architected and by whom, including whether a system integrator was involved. User Access and security are also defined at the system/application levels. However, Caltrans applies general guidelines to help ensure that business program/division-owned systems are protected. Caltrans also has specific procedures on security and addressing cyber-attacks, from a broader network and security perspective, rather than only a data or system perspective.

That said, a number of offices in Caltrans are considering their approach to data governance, including master data management. Caltrans recognizes further data integration across current and next generation systems is critical to future operations. For example, sharing data across the Project Delivery Lifecycle (e.g., roadway design, procurement/contracting, construction) is vital to improving the construction management process. It is also important to downstream processes like roadway maintenance and operations, as well as transparency and sharing information with other agencies and stakeholders.

Recognizing the need for promoting data governance across GIS usage throughout Caltrans, the position of Geospatial Data Officer (GDO) was established and filled in 2017.

As noted above, Caltrans data is governed at the system level, and managed by the business programs/divisions. Metadata management, data reconciliation, validation, and cleansing occur at the system level. User Access and security are also defined at the system/application levels. Data-related policies and standards exist at the system level. For example, the Integrated Maintenance and Management System (IMMS) has a specific taxonomy and directives around how data is to be captured and entered into specific IMMS fields, such as how a District or a given highway asset is represented in the system. The system also has data validations built into the individual systems to ensure that users enter valid data, such as a District.

However, there is not yet a defined and documented enterprise-wide data governance policy or standards. For example, from system to system, there may be slightly different taxonomies and standards, such as listing District 1 as D1, D01 or just 1 in a field named "District."

Caltrans recognizes that a key goal of its future data governance process is to define select data at an enterprise level so that it can more easily be shared across the organization.

Caltrans has information security policies and controls in place to safeguard and maintain data confidentiality, integrity, protection, and availability, and otherwise protect the Department's information assets.

Caltrans Deputy Directive (DD55 2) distributes policy responsibility and control implementation to applicable business units. Business units that manage data with regulatory requirements, maintain strict control over access and data use procedures. With distributed responsibility, Caltrans Information Security Office (CISO) does not have visibility into the level of formality and documentation implemented by the business units. Caltrans' Audits and Investigations Office is responsible for the monitoring and reporting of security and privacy policies.

The CISO, though, has identified data classification and incident management deficiencies in the Plan of Action and Milestones (POAM), which is forecasted to be completed by December 31, 2018. Additionally, in September, 2017, the CISO released a Cybersecurity Roadmap (2017 - 2022) listing multiple waves of activities including specific activities around governance and data management. Further, the CISO has recently released an "Information Storage Security Practice" document which provides protocols and best practices regarding storing documents securely.

Customer/Program:
- Division of Research, Innovation, and System Information maintains the accident and inventory modules of the Transportation Network System (TSN).
- They collect and analyze report statistics related to fiscal status, physical and geometric extent, performance and designation of the State's roadway systems in order to make performance-based decisions about transportation services and infrastructure.
- Goal is to reduce the number and severity of traffic crashes by ensuring opportunities to improve highway safety are identified and implemented during all phases of highway planning and operation.

Current System/Process:
- TSN is the departmental database used to maintain and link traffic census, collision, and highway inventory data for the state-owned transportation system. It serves as the base information system for all traffic safety analysis.
- Database includes the highway inventory for all State highway facilities in California.
- TSN provides data used to generate reports identifying highway locations for investigation.

Problem/Opportunity:
- TSN lacks ability to collect or report on safety/accident data or provide temporal, historical, or geolocation data as required by MAP-21, FAST Act and other federal requirements..
- TSN lacks the ability to integrate efficiently with external agencies to identify fatalities and accidents on local roads.
- TSN lacks the ability for collaboration and access across the Department.
- TSN is unable to address new safety analysis functionality as required by FHWA.
- TSN is based on obsolete technology and lacks the ability to interface efficiently with other systems.

Current Process Risks:
- An inability to meet federal reporting requirements as specified by MAP-21 and the FAST Act.

Proposed Project Scope:
- Replace the existing Transportation System Network .

Benefits of Proposal:
- Allows the Department to meet the federal requirements and address technology deficiencies in the current system.

Project Risks:
- No known risks. .

Next Steps:
- Move forward with requirements gathering and alternative analysis (S2AA).

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