Stage 2 Preliminary Assessment

2.1 General Information

Agency or State Entity Name:	
California Department of Transportation, Division of Traffic Operations	
Organization Code:	
2660	
Proposal Name:	
California Advanced Transportation Management System (CATMS) Project	
Department of Technology Project Number:	2660-546

2.2 Preliminary Submittal Information

Contact Information:	
Contact First Name:	**Contact Last Name:**
Alan	Benson
Contact Email:	**Contact Phone:**
alan.benson@dot.ca.gov	(916) 654-3863
Preliminary Submission Date:	**Preliminary Assessment Transmittal**:
6/1/2021	(Include transmittal as an attachment to your email submission.) Attached S1BA Modified & S2PA (Not Needed)

2.3 Stage 2 Preliminary Assessment

2.3.1 Impact Assessment

	Yes	No
1. Has the Agency/state entity identified and committed subject matter experts from all business sponsors and key stakeholders?	☒	☐
2. Are all current baseline systems that will be impacted by this proposal documented and current (e.g., data classification and data exchange agreements, privacy impact assessments, design documents, data flow diagram, data dictionary, application code, architecture descriptions)?	☒	☐
3. Does the Agency/state entity anticipate needing support from the California Department of Technology (CDT) Statewide Technology Procurement (STP) to conduct market research for this proposal (Market Survey, Request for Information)?	☐	☒
4. Does the Agency/state entity anticipate submitting a budget request to support the procurement activities of this proposal?	☐	☒
5. Could this proposal involve the development and/or purchase of systems to support activities included in Financial Information System for California (FI$Cal) (e.g., financial accounting, asset management, human resources, procurement/ordering, inventory management, facilities management)?	☐	☒
6. Does the Agency/state entity have a designated Chief Architect or Enterprise Architect to lead the development of baseline and alternative solutions architecture descriptions?	☒	☐
7. Will the Agency/state entity's Information Security Officer be involved in the development and review of any security related requirements?	☒	☐
8. Does the Agency/state entity anticipate performing a business-based procurement to have vendors propose a solution?	☐	☒

2.3.2 Business Complexity Assessment

Stage 2 Preliminary Assessment

Business Complexity:	2.4	Business Complexity Zone:	☐	High	☒	Medium	☐ Low

Stage 2 Alternatives Analysis

2.4 Submittal Information

Contact Information:

Contact First Name:	Contact Last Name:
Alan	Benson
Contact Email:	**Contact Phone:**
alan.benson@dot.ca.gov	(916) 654-3863
Submission Date:	**Project Approval Executive Transmittal:**
6/1/2021	(Include transmittal as an attachment to your email submission.) CATMS SIMM_19G1-Project_Approval_Executive_Transmittal.docx

Submission Type:

- ☒ New Submission
- ☐ Updated Submission (Pre-Approval)
- ☐ Updated Submission (Post-Approval)
- ☐ Withdraw Submission
  - Reason: Select...
  - If "Other," specify:

Sections Updated (For Updated Submissions Only) – (check all that apply)

- ☐ 2.1 General Information
- ☐ 2.2 Preliminary Submittal Information
- ☐ 2.3 Stage 2 Preliminary Assessment
  - ☐ 2.3.1 Impact Assessment
  - ☐ 2.3.2 Business Complexity Assessment
- ☐ 2.4 Submittal Information
- ☐ 2.5 Baseline Processes and Systems
  - ☐ 2.5.1 Description
  - ☐ 2.5.2 Business Process Workflow
  - ☐ 2.5.3 Current Architecture Information
  - ☐ 2.5.4 Current Architecture Diagram
  - ☐ 2.5.5 Security Categorization Impact Table
- ☐ 2.6 Mid-Level Solution Requirements
- ☐ 2.7 Assumptions and Constraints
- ☐ 2.8 Dependencies
- ☐ 2.9 Market Research
  - ☐ 2.9.1 Market Research Methodologies/Timeframes
  - ☐ 2.9.2 Results of Market Research
- ☐ 2.10 Alternative Solutions
  - ☐ 2.10.1 Solution Type)
    - ☐ Recommended
    - ☐ Alternative
  - ☐ 2.10.2 Name
  - ☐ 2.10.3 Description
  - ☐ 2.10.4 Benefit Analysis
  - ☐ 2.10.5 Assumptions and Constraints
  - ☐ 2.10.6 Implementation Approach
  - ☐ 2.10.7 Architecture Information
- ☐ 2.11 Recommended Solution
  - ☐ 2.11.1 Rationale for Selection
  - ☐ 2.11.2 Technical/Initial IT Project Oversight Framework Complexit Assessment
  - ☐ 2.11.3 Procurement and Staffing Strategy
  - ☐ 2.11.4 Enterprise Architecture Alignment
  - ☐ 2.11.5 Project Phases
  - ☐ 2.11.6 High Level Proposed Project Schedule
  - ☐ 2.11.7 Cost Summary
- ☐ 2.12 Staffing Plan
  - ☐ 2.12.1 Administrative
  - ☐ 2.12.2 Business Program
  - ☐ 2.12.3 Information Technology (IT)
  - ☐ 2.12.4 Testing
  - ☐ 2.12.5 Data Conversion/Migration
  - ☐ 2.12.6 Training and Organizational Change Management
  - ☐ 2.12.7 Resource Capacity/Skills/Knowledge for Stage 3 Solution Development
  - ☐ 2.12.8 Project Management
    - ☐ 2.12.8.1 Project Management Maturity Assessment
    - ☐ 2.12.8.2 Project Management Planning
  - ☐ 2.12.9 Organization Charts
- ☐ 2.13 Data Conversion/Migration
- ☐ 2.14 Financial Analysis Worksheets

Summary of Changes:

No changes. Only need to complete on re-submission.

Condition(s) from Previous Stage(s):	
Condition #	….
Condition Category	Select...
Other, specify	….
Condition Sub-category	Select...
Other, specify	….
Condition	
Assessment	Select...
Other, specify	….
Agency/state Entity Response	
Status	Select...
Other, specify	….
Select + to add conditions.	

2.5 Baseline Processes and Systems

2.5.1 Description

The California Department of Transportation (Caltrans), Division of Traffic Operations, proposes to replace the Intelligent Transportation Systems (ITS) in all 12 Caltrans Transportation Management Centers (TMC) with a single uniform system to manage traffic on the state's highway network. TMCs currently use 12 different systems in various combinations, some of which are 25 years old. The new system will allow Caltrans to standardize processes and training, improve interoperability and redundancy across TMCs, and reduce system licensing and maintenance costs.

The high-level business functions that will need to be addressed by the proposed system cover the four main functional areas:

- Transportation Management Center (TMC) Operations – This key operational area is the focus for operators, dispatchers, and transportation engineers within each of the 12 districts. The core function of the TMC is improve safety through managing incidents, events, traffic congestion, environmental conditions (e.g. winter, fire, flooding, etc.), regional operations, queue warnings, and to communicate traveler information which covers key functions such as Activity Logging, Configuration, Connected Vehicles, Managed Lanes, Camera Control and Video Management (e.g. Bosch, etc.), Changeable Message Signs (CMS), Environmental Information, Highway Advisory Radio, and data presentation.
- Ramp Metering Operations & Support – This operational and support function focuses on monitoring the ramp metering operation, maintaining the Ramp Metering plans using Adaptive Ramp Metering, configuration, and Main Line Metering.
- Transportation Management System (TMS) Support – This support function entails asset management and maintaining the complex hardware, technologies, and processes for performing an array of functions and communications. Disruptions or failures in the performance of these functions can impact traffic safety, reduce system capacity, and ultimately lead the traveling public to lose faith in the transportation network. System failures also have the potential to cause measurable economic loss and increase congestion, fuel consumption, pollutants, and traffic crashes. The problem is further complicated by the fact that today's systems, subsystems, and components often are highly interdependent, meaning that a single malfunction can critically impact the ability of the overall systems to perform their intended functions.
- Central Systems Support – This support function allows for key administrative activities to be performed to maintain the central systems. Managing the support personnel's Single Sign-On roles, permissions, and groups is a key function to maintain strict security standards. This area also allows for reporting and the use of performance dashboards to monitor the on-going support of the systems including data acquisition, command and control, computing, and private TMC network management.

The Caltrans ITS systems that CATMS will replace include:

- Advanced Transportation Management System (ATMS) / ATMS Replacement (ATMSR) -- is a legacy and replacement system used to manage the freeway system using vehicle detectors and video from roadside cameras. The ATMS /ATMSR also sends Operator messages and travel times to variable message signs and controls roadside video cameras. The ATMS /ATMSR contains an event management application that monitors incidents and provides the Operator incident response plans that are used to manage incidents in real-time. Six Caltrans Districts use the ATMS and four Districts will use ATMSR as an interim solution until CATMS is implemented.
- Intelligent Roadway Information System (IRIS) -- is a system that monitors the freeway system and roadside weather systems. IRIS also controls field devices such as CMS and roadside cameras. IRIS is used primarily in rural Districts.
- Satellite Operations Command and Control System (SOCCS) -- is a system to control CMS and roadside cameras. SOCCS is used as a primary system in a single Caltrans District. In addition, in District 2, 3, 9, 11 and 12, SOCCS is used as a back-up for controlling CMS.
- Ramp Metering Information System (RMIS) -- collects traffic data from field devices every thirty (30) seconds then feeds continously data to ATMS and sends raw data to the Performance Measurement System (PeMS) using an Extensible Markup Language (XML) file. The user interface also displays real time ramp metering data which allows users to control and modify online field controllers and the controllers are displayed on interactive map. RMIS is used in six Districts.
- PC Data Concentrator (PCDC) -- the PCDC provides the ATMS with the ability to interact with field equipment including Vehicle Detection Station (VDS), Ramp Metering System (RMS), Multi-Lane Metering System (MLMS) and Extinguishable Message Sign (EMS) devices. PCDC is utilized in District 4.
- Camera Control System (CCS) – the CCS is a camera control system used in District Transportation Management Centers to monitor traffic and confirm incidents. CCS is used in Districts 4 and 11.
- Transportation Management Center Activity Log (TMCAL) -- is primarily an event recording system used to log activities of both the TMC Operators and TMC Dispatchers. TMCAL has interfaces to systems such as Caltrans Highway Information Network (CHIN), California Highway Patrol (CHP) Media CAD, and QuickMap (and One Stop Shop [OSS]) via the Commercial Wholesale Web Portal (CWWP2). This system is deployed in many Districts but some Districts use other activity logging systems such as DIAL, BAIRS, TMCAD, and IETMC.
- Transportation Management Computer Aided Dispatch (TMCAD) -- is primarily an event recording system used to log activities of both the TMC Operators and TMC Dispatchers. TMCAD is used in Districts 5, 6 and 10.
- District Incident Activity Log (DIAL) -- Web-based event recording systems used to log activities of Operators for incident management. DIAL has the capability to email detailed Incident History Reports and Incident Summaries. DIAL is used in District 12.
- Bay Area Incident Response System (BAIRS) -- is primarily an event recording system used to log activities of both the TMC Operators and TMC Dispatchers. BAIRS is used in District 4.
- Fog Detection and Warning System (FDWS) – the FDWS consists of visibility sensors, speed detectors and cameras to detect congestion and visibility problems that could affect driver and passenger safety. FDWS is used in District 6.
- Inland Empire Transportation Management Center (IETMC) -- is primarily an event recording system used to log activities of both the TMC Operators and TMC Dispatchers. IETMC is used in Districts 8.

2.5.2 Business Process Workflow

The four main business functional areas (TMC Operations, Ramp Metering Operations & Support, TMS Support, and Central Systems Support) are further detailed out to list individual business functions and which legacy system provides that business function in the current systems environment.

The figure below, (Figure 1), shows the comparison of the impacted legacy systems that would be replaced by CATMS and the current business function that each system currently supports.

Figure 1 CATMS Business Function to Legacy System Comparison

	SYSTEM											
Functional Area (bolded) and Business Functionality	**ATMS**	**IRIS**	**SOCCS**	**TMCAL**	**DIAL**	**TMCAD**	**BAIRS**	**PCDC**	**RMIS**	**CCS**	**FDWS**	**IETMC**
TMC Operations												
Activity Logging	X			X	X	X	X					X
Camera Control	X	X	X							X		
Chain Control				X		X						
Dynamic Lane Control	X											
Electronic Message Boards	X											
Environmental Information / Roadway Weather Information System (RWIS)		X									X	
Incident Management	X			X								
Congestion Management	X	X										
Special Event Management	X											
Debris Management	X			X	X	X	X					
Highway Advisory Radio (i.e. MH Corbin Platinum)	X											
High Occupancy Toll/Managed Lanes	X											
Integrated Corridor Management	X											
Changeable Message Signs	X	X	X	X								
Notification and Callouts							X					
Reporting	X	X	X	X	X	X	X	X	X	X	X	X
Travel Times	X	X										
Traveler Information	X	X		X								
User Interface	X	X	X	X	X	X	X	X	X	X	X	X
Video Wall, Display, and Distribution	X	X	X									
Ramp Metering Operations & Support												
Adaptive Ramp Metering	X											
Configuration	X							X	X			
Main Line Metering	X											

Ramp Metering	X							X	X			
Queue Warning System (WQS)	X											
Traffic Sensors	X	X						X	X			
Reporting	X							X	X			
TMS Field Support												
Configuration	X	X	X					X	X	X	X	
Reporting	X	X	X					X	X	X	X	
Diagnostics	X	X	X	X	X	X	X	X	X	X	X	
Central Systems Support												
Administration	X	X	X	X	X	X	X	X	X	X	X	
Network Management	X	X	X	X	X	X	X	X	X	X	X	
Configuration	X	X	X	X	X	X	X	X	X	X	X	
Diagnostics	X	X	X	X	X	X	X	X	X	X	X	
Reporting	X	X	X	X	X	X	X	X	X	X	X	

The figure below, (Figure 2), shows the comparison of the major business process workflow diagrams and the legacy systems impacted or referenced within these workflows.

Figure 2 CATMS As-Is Business Process Workflows to Legacy System Comparison

	SYSTEM											
As-Is Business Process	**ATMS**	**IRIS**	**SOCCS**	**TMCAL**	**DIAL**	**TMCAD**	**BAIRS**	**PCDC**	**RMIS**	**CCS**	**FDWS**	**IETMC**
Activity Logging	X			X	X	X	X					X
Automated Warning System		X									X	
Performance & Mandated Reports	X			X	X	X	X	X	X			
Ramp Metering	X	X						X	X			
Central Systems Support Process	X	X	X	X	X	X	X		X	X	X	
Traveler Information	X	X	X	X	X		X					

Each of the six As-Is Business Process workflow diagrams depicts the current operational environment and how each of the 12 legacy systems is performing the current business functions.

Attachment: Attachment 2 - CATMS As-Is Business Processes.pdf, Attachment 2 - CATMS As-Is Business Process Narratives.pdf

2.5.3 Current Architecture Information

The current architecture information listed below describes multiple business processes, multiple applications, and unique documentation for each of the 12 districts within Caltrans. The current architecture information is structured within this document as follows:

- Business Processes attributed to each legacy Application/System

- Application/System – Each of the 12 legacy applications/systems (Title is **Bolded**)
- Details associated with each Application/System – includes General Information, Runtime, Interfaces, Security, and Data Management.

Business Function/Process(es)		Activity Logging		
Business Function/Process(es)		Performance & Mandated Reports		
Business Function/Process(es)		Ramp Metering		
Business Function/Process(es)		Central Systems Support Process		
Business Function/Process(es)		Traveler Information		
Select + to add a business process with the same application, system, or component; COTS, MOTS, or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component		**Advanced Transportation Management System (ATMS) / ATMS Replacement (ATMSR)**		
		Select + to add an application, system, or component.		
COTS, MOTS or Custom		Custom application		
Name/Primary Technology:		ATMS / Oracle 12c ; ATMSR / SQL Server		
Runtime Environment	Cloud Computing Used?	☒ Yes ☐ No	If "Yes," specify:	Infrastructure as a Service (IaaS)
	Server/Device Function	Application, Database, and Reporting Server		
	Hardware	HP Integrity Blade ; HP ProLiant		
	Operating System	HP-UX B.11.31 U ia64 ; Windows Server		
	System Software	Tibco SmartSockets (ATMS only)		
	System Software	Gensym G2 (ATMS only)		
	System Software	Oracle 12c, Oracle 11g ; SQL Server		
	System Software	Oracle Fusion Middleware (ATMS only)		
		Select + to add system software.		
System Interfaces		Internal - Ramp Metering Information System (RMIS), Performance Measurement System (PeMS), Commercial Wholesale Web Portal (CWWP), Velocity External – CHP Media CAD, Travel Time Data Sources, ICM, Regional Integration of Intelligent Transportation Systems (RITTS), AWS for ICM systems in District 7		
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity ATMS / ATMSR is hosted in State computer rooms and is operated by the State, but in District 7 the functionality and compute required for ICM is hosted in Amazon Web Services.		
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:		
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:		
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:		
Data Management	Data Owner	Name, Title, Program: D3 – Isam Tabshouri, TMC Operations Functional Manager, Traffic Operations; D4 – Ramin Bolourchian, TMC Operations Functional Manager, Traffic Operations; D7 – David Lau, TMC Operations Functional Manager, Traffic Operations; D8 – Yong Kim, TMC Operations Functional Manager, Traffic Operations; D11 – Margie Perez, TMC Operations Functional Manager, Traffic		

		Operations; D12 - Saeed Nafisi, TMC Operations Functional Manager, Traffic Operations	
	Data Custodian	Name, Title, Program: D3 – Andres Chavez, Central Systems Functional Manager, Traffic Operations; D4 – Hector Garcia, Central Systems Functional Manager, Traffic Operations; D7 – Hung Tran, Central Systems Support, Traffic Operations; D8 – Rix Ng, Central Systems Support, Traffic Operations; D11 – Harrison Makau, Central Systems Support, Traffic Operations; D12 - Glenn Hayashida, Central Systems Support, Traffic Operations	
Business Function/Process(es)		Automated Warning System	
Business Function/Process(es)		Ramp Metering	
Business Function/Process(es)		Central Systems Support Process	
Business Function/Process(es)		Traveler Information	
Select + to add a business process with the same application, system, or component; COTS, MOTS, or custom solution; runtime environment; system interfaces, data center location; and, security.			
Application, System or Component		**Intelligent Roadway Information System (IRIS)**	
		Select + to add an application, system, or component.	
COTS, MOTS or Custom		Custom application	
Name/Primary Technology:		IRIS / Apache 2 / Java / Tomcat	
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:
	Server/Device Function	Application, Database, and Map Tiles	
	Hardware	HP ProLiant	
	Operating System	SLES v11 SP 2	
	System Software	Apache 2/Java/VMWare	
	System Software	Postgres	
		Select + to add system software.	
System Interfaces		Internal – Performance Measurement System (PeMS)	
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State	
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☒ Other, specify: Contractors via VPN access	
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:	
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:	
Data Management	Data Owner	Name, Title, Program: D1 - Sheri Rodriguez, Central Systems Functional Manager, Traffic Operations; D2 – Bill Sutherland (acting), TMC Operations Functional Manager, Traffic Operations; D5 – Roger Barnes, TMC Operations Manager, Traffic Operations; D6 – Joel Aguilar, TMC Operations Functional Manager, Traffic Operations; D10 – Wille Kuhl, TMC Operations Functional Manager, Traffic Operations	
	Data Custodian	Name, Title, Program: D1 - Sean Larson, Central Systems Support, Traffic Operations; D2 – Keith Koeppen, Central Systems Support, Traffic Operations; D5 – Steven Gee, Central Systems Support, Traffic Operations; D6 – Sam Campos, Central Systems Functional Manager,	

2.7 Assumptions and Constraints

		Traffic Operations; D10 – Arlene Cordero, Central Systems Support, Traffic Operations		
Business Function/Process(es)		Central Systems Support Process		
Business Function/Process(es)		Automated Warning System		
Business Function/Process(es)		Traveler Information		
Select + to add a business process with the same application, system, or component; COTS, MOTS, or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component		**Satellite Operations Command and Control System (SOCCS)**		
		Select + to add an application, system, or component.		
COTS, MOTS or Custom		Custom application		
Name/Primary Technology:		SOCCS / Apache / Java		
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:	
	Server/Device Function	Application and Database		
	Hardware	HP ProLiant, Moxa DA661		
	Operating System	Fedora v23, v24 / Custom Debian		
	System Software	Apache		
	System Software	Perl		
		Select + to add system software.		
System Interfaces		Internal – Commercial Wholesale Web Portal (CWWP)		
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State		
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:		
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:		
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:		
Data Management	Data Owner	Name, Title, Program: D2 – Jeremiah Pearce, TMS Functional Manager, D9 – Lianne Talbot, TMC Operations Functional Manager, Traffic Operations		
	Data Custodian	Name, Title, Program: D2 – Keith Koeppen, Central Systems Support, D9 – Michael Cooper, IT Support, Information Technology		
Business Function/Process(es)		Activity Logging		
Business Function/Process(es)		Performance & Mandated Reports		
Business Function/Process(es)		Central Systems Support Process		
Business Function/Process(es)		Traveler Information		
Select + to add a business process with the same application, system, or component; COTS, MOTS or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component		**Transportation Management Center Activity Log (TMCAL)**		
		Select + to add an application, system, or component.		
COTS, MOTS or Custom		Custom application		
Name/Primary Technology:		TMCAL / MySQL / PHP		
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:	
	Server/Device Function	Application and Database		
	Hardware	HP ProLiant		

	Operating System	SLES v11, SLES v12 SP2
	System Software	MySQL v5.5, VMWare, PHP
Select + to add system software.		
System Interfaces		Internal – HQ TMCAL, CWWP2 External – CHP Media CAD
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:
Data Management	Data Owner	Name, Title, Program: D1 – Sheri Rodriquez, Central Systems Functional Manager, Traffic Operations; D2 – Bill Sutherland (acting), TMC Operations Functional Manager, Traffic Operations; D3 – Isam Tabshouri, TMC Operations Functional Manager, Traffic Operations; D4 – Ramin Bolourchian, TMC Operations Functional Manager, Traffic Operations; D5 – Roger Barnes, TMC Operations Functional Manager, Traffic Operations; D6 – Joel Aguilar, TMC Operations Functional Manager, Traffic Operations; D7 – David Lau, TMC Operations Functional Manager, Traffic Operations; D8 – Mari Padres, TMC Operations Functional Manager, Traffic Operations; D9 – Lianne Talbot, TMC Operations Functional Manager, Traffic Operations; D10 – Wille Kuhl, TMC Operations Functional Manager, Traffic Operations; D11 – Margie Perez, TMC Operations Functional Manager, Traffic Operations; D12 – Saeed Nafisi, TMC Operations Functional Manager, Traffic Operations
	Data Custodian	Name, Title, Program: D1 – Anthony Carnemolla, Central Systems Support, Traffic Operations; D2 – Keith Koeppen, Central Systems Support, Traffic Operations; D3 – Andres Chavez, Central Systems Functional Manager, Traffic Operations; D4 – Hector Garcia, Central Systems Functional Manager, Traffic Operations; D5 – Steven Gee, Central Systems Support, Traffic Operations; D6 – Sam Campos, Central Systems Functional Manager, Traffic Operations; D7 – Hung Tran, Central Systems Support, Traffic Operations; D8 – Rix Ng, Central Systems Support, Traffic Operations; D9 – Michael Cooper, IT Support, Information Technology; D10 – Arlene Cordero, Central Systems Support, Traffic Operations; D11 – Harrison Makau, Central Systems Support, Traffic Operations; D12 – Glenn Hayashida, Central Systems Support, Traffic Operations
Business Function/Process(es)		Activity Logging
Business Function/Process(es)		Performance & Mandated Reports
Business Function/Process(es)		Central Systems Support Processes
Business Function/Process(es)		Traveler Information
Select + to add a business process with the same application, system, or component; COTS, MOTS or custom solution; runtime environment; system interfaces, data center location; and, security.		
Application, System or Component		**Daily Incident Activity Log (DIAL)**

		Select + to add an application, system, or component.		
COTS, MOTS or Custom		Custom application		
Name/Primary Technology:		DIAL / MySQL / Perl		
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:	
	Server/Device Function	Application and Database		
	Hardware	Sunfire X2200		
	Operating System	Oracle Solaris 10		
	System Software	Apache, Perl		
	System Software	MySQL 5.1.31		
		Select + to add system software.		
System Interfaces		Internal – CHIN External – CHP Media CAD		
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State		
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:		
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:		
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:		
Data Management	Data Owner	Name, Title, Program: D12 – Saeed Nafisi, TMC Operations Functional Manager, Traffic Operations		
	Data Custodian	Name, Title, Program: D12 - Glenn Hayashida, Central Systems Support, Traffic Operations		
Business Function/Process(es)		Activity Logging		
Business Function/Process(es)		Performance & Mandated Reports		
Business Function/Process(es)		Central Systems Support Process		
Select + to add a business process with the same application, system, or component; COTS, MOTS or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component		**Transportation Management Computer Aided Dispatch (TMCAD)**		
		Select + to add an application, system, or component.		
COTS, MOTS or Custom		Custom application		
Name/Primary Technology:		TMCAD / SQL Server		
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:	
	Server/Device Function	Application and Database		
	Hardware	HP ProLiant		
	Operating System	Windows Server 2012		
	System Software	SQL Server, Visual Basic		
		Select + to add system software.		
System Interfaces		Internal – None External – CHP Media CAD		
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State		
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:		

	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:
Data Management	Data Owner	Name, Title, Program: D5 – Roger Barnes, TMC Operations Functional Manager, Traffic Operations; D6 – Joel Aguilar, TMC Operations Functional Manager, Traffic Operations; D10 – Willie Kuhl, TMC Operations Functional Manager
	Data Custodian	Name, Title, Program: D5 – Steven Gee, Central Systems Support, Traffic Operations; D6 – Sam Campos, Central Systems Functional Manager, Traffic Operations; D10 – Arlene Cordero, Central Systems Functional Manager
Business Function/Process(es)		Activity Logging
Business Function/Process(es)		Performance & Mandated Reports
Business Function/Process(es)		Central Systems Support Process
Business Function/Process(es)		Traveler Information
Select + to add a business process with the same application, system, or component; COTS, MOTS or custom solution; runtime environment; system interfaces, data center location; and, security.		
Application, System or Component		**Bay Area Incident Response System (BAIRS)**
		Select + to add an application, system, or component.
COTS, MOTS or Custom		Custom application
Name/Primary Technology:		BAIRS / Oracle 12c
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No If "Yes," specify:
	Server/Device Function	Application and Database
	Hardware	HP ProLiant
	Operating System	HP UX / Oracle 12c
	System Software	PHP
	System Software	JavaScript
		Select + to add system software.
System Interfaces		Internal – None External – None
Data Center Location	Other, specify	State data center operated by CDT Click here to enter text.
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:
Data Management	Data Owner	Name, Title, Program: D4 – Tara Tabezud, TMC Operations Dispatcher, Traffic Operations
	Data Custodian	Name, Title, Program: D4 – Don Wilbur, Central Systems Functional Manager, Headquarters IT
Business Function/Process(es)		Performance & Mandated Reports
Business Function/Process(es)		Ramp Metering

Select + to add a business process with the same application, system, or component; COTS, MOTS, or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component		**PC Data Concentrator (PCDC)**		
		Select + to add an application, system, or component.		
COTS, MOTS or Custom		Custom application		
Name/Primary Technology:		PCDC / Windows Server 2008 / Java		
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:	
	Server/Device Function	Application		
	Hardware	HP ProLiant		
	Operating System	Windows Server 2008		
	System Software	Java 6		
		Select + to add system software.		
System Interfaces		Internal – None External – None		
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State		
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:		
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:		
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:		
Data Management	Data Owner	Name, Title, Program: D4 – Ramin Bolourchian, TMC Operations Functional Manager, Traffic Operations		
	Data Custodian	Name, Title, Program: D4 – Hector Garcia, Central Systems Functional Manager, Traffic Operations		
Business Function/Process(es)		Performance & Mandated Reports		
Business Function/Process(es)		Ramp Metering		
Business Function/Process(es)		Central Systems Support Process		
Select + to add a business process with the same application, system, or component; COTS, MOTS, or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component		**Ramp Metering Information System (RMIS)**		
		Select + to add an application, system, or component.		
COTS, MOTS or Custom		Custom application		
Name/Primary Technology:		RMIS / MySQL		
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:	
	Server/Device Function	Application and Database		
	Hardware	HP ProLiant		
	Operating System	Free DSB Pre 11, 11.2		
	System Software	MySQL, Microsoft C#		
		Select + to add system software.		
System Interfaces		Internal – ATMS, PeMS External – None		
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State		

Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:
Data Management	Data Owner	Name, Title, Program: D3 – Isam Tabshouri, TMC Operations Functional Manager, Traffic Operations; D5 – Roger Barnes, TMC Operations Functional Manager, Traffic Operations; D6 – Joel Aguilar, TMC Operations Functional Manager, Traffic Operations; D7 – David Lau, TMC Operations Functional Manager, Traffic Operations; D8 – Yong Kim, TMC Operations Functional Manager, Traffic Operations; D10 – Wille Kuhl, TMC Operations Functional Manager, Traffic Operations; D11 – Margie Perez, TMC Operations Functional Manager, Traffic Operations; D12 - Saeed Nafisi, TMC Operations Functional Manager, Traffic Operations
	Data Custodian	Name, Title, Program: D3 – Andres Chavez, Central Systems Functional Manager, Traffic Operations; D5 – Steven Gee, Central Systems Support, Traffic Operations; D6 – Sam Campos, Central Systems Functional Manager, Traffic Operations; D7 – Hung Tran, Central Systems Support, Traffic Operations; D8 – Rix Ng, Central Systems Support, Traffic Operations; D10 – Arlene Cordero, Central Systems Support, Traffic Operations; D11 – Harrison Makau, Central Systems Support, Traffic Operations; D12 – Glenn Hayashida, Central Systems Support, Traffic Operations
Business Function/Process(es)		Central Systems Support Process
Select + to add a business process with the same application, system, or component; COTS, MOTS, or custom solution; runtime environment; system interfaces, data center location; and, security.		
Application, System or Component		**Camera Control System (CCS)**
		Select + to add an application, system, or component.
COTS, MOTS or Custom		Commerical off-the-shelf (COTS)
Name/Primary Technology:		Cameleon CCS / Cameleon ITS
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No — If "Yes," specify:
	Server/Device Function	Application
	Hardware	HP ProLiant, Dell PowerEdge
	Operating System	Windows Server 2008 R2
	System Software	Cameleon ITS
		Select + to add system software.
System Interfaces		Internal – None External – None
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:

	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:		
Data Management	Data Owner	Name, Title, Program: D4 – Ramin Bolourchian, TMC Operations Functional Manager, Traffic Operations; D11 – Margie Perez, TMC Operations Functional Manager, Traffic Operations		
	Data Custodian	Name, Title, Program: D4 – Hector Garcia, Central Systems Functional Manager, Traffic Operations; D11 - Harrison Makau, Central Systems Support, Traffic Operations		
Business Function/Process(es)		Automated Warning System		
Business Function/Process(es)		Central Systems Support Process		
Select + to add a business process with the same application, system, or component; COTS, MOTS, or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component		**Fog Detection Warning System (FDWS)**		
		Select + to add an application, system, or component.		
COTS, MOTS or Custom		Modified off-the-shelf (MOTS)		
Name/Primary Technology:		Cameleon ITS / Windows Server		
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:	
	Server/Device Function	Application		
	Hardware	HP ProLiant		
	Operating System	Windows Server 2008 R2		
	System Software	Cameleon ITS		
Select + to add system software.				
System Interfaces		Internal – None External – None		
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State		
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:		
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:		
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:		
Data Management	Data Owner	Name, Title, Program: D6 – Joel Aguilar, TMC Operations Functional Manager, Traffic Operations		
	Data Custodian	Name, Title, Program: D6 – Sam Campos, Central Systems Functional Manager, Traffic Operations		
Business Function/Process(es)		Activity Logging		
Select + to add a business process with the same application, system, or component; COTS, MOTS, or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component		**Inland Empire Transportation Management Center (IETMC)**		
		Select + to add an application, system, or component.		
COTS, MOTS or Custom		Custom application		
Name/Primary Technology:		IETMC / Apache2 / Perl		
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:	

	Server/Device Function	Application and Database
	Hardware	HP ProLiant
	Operating System	Debian9
	System Software	MySQL v5.x, Apache2, Perl
Select + to add system software.		
System Interfaces		Internal – None External – CHP Media CAD
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:
Data Management	Data Owner	Name, Title, Program: Traffic Operations; D8 – Yong Kim, TMC Operations Functional Manager
	Data Custodian	Name, Title, Program: Traffic Operations; D8 – Rix Ng, Central Systems Support
Select + to add business functions/processes.		

2.5.4 Current Architecture Diagram

The attached current architecture diagram decomposes each of the 12 Districts individually to depict the unique environments in each District.

Attachment: Attachment 2 - CATMS As-Is Architecture.pdf, Attachment 2 - CATMS As-Is System Architecture Information.pdf

2.5.5 Security Categorization Impact Table

CATMS will be the data repository for information related to the following business processes:

- Activity Logging
- Automated Warning System
- Performance & Mandated Reports
- Ramp Metering
- Central System Support Processes
- Traveler Information

The table below further decomposes the information stored for each business process:

Information Type	Description of Information Type
Activity Logging	Contains data related to incident management and planned closures for the state highway system. The types of data relating to incident management are the following: general incident with maintenance personnel information, number of fatalities, public amber alert message, debris, nuclear gauge testing, injury to Caltrans or contractor employee, damage to Caltrans structures, facilities, vehicles or equipment, safety campaign messages, and weather or natural event. The types of data relating to planned closures are the following: lane closure, emergency lane closure, push notification of closures, construction, chain control, and special planned event.

Assumptions/Constraints	Description/Potential Impact

Automated Warning System	Stores information related to a mapping of the monitored roads showing ITS components, current average speed, measured atmospheric and pavement conditions, and the displayed CMS messages.
Performance & Mandated Reports	Leverages data from various systems and the other business processes to provide reporting of traffic operations and performance against quality standards.
Ramp Metering	Ramp meters are installed on freeway on-ramps to control the frequency at which vehicles enter the flow of traffic on the mainline. Vehicle occupancy (% of time vehicle traverse over loop detectors), volume, and speed information is stored as part of this business process.
Central System Support Processes	The type of information stored pertains to the management of support tickets for local TMC Central System Support personnel to maintain servers and applications, troubleshooting and diagnosing workstations, applying application and security patches, hardware components troubleshooting, diagnosing, and/or replacement, or general user administration.
Traveler Information	Stores and establishes a consistent statewide traveler information and data reporting policy to maximize the widespread availability of multimodal, multi-agency traveler information from government, commercial and media sources. Data includes real-time traffic and travel conditions on the State Highway System for the public.

The table below provides an assessment of each information type against Federal Information Processing Standards (FIPS) Publication 199 and Federal Information Security Management Act (FISMA) security objectives which are also referenced:

Information Type	Data Classification (Public / Confidential)	Confidentiality Impact	Integrity Impact	Availability Impact
Activity Logging	Public	Moderate	Moderate	High
Automated Warning System	Public	Moderate	Moderate	High
Performance & Mandated Reports	Public	Moderate	Moderate	High
Traveler Information	Public	Moderate	Moderate	High
Central System Support Processes	Public	Moderate	Moderate	High
Ramp Metering (Control data)	Public	Moderate	Moderate	High
Ramp Metering (Traffic data)	Public	Moderate	Moderate	High
Final Impact Categorization:		Moderate	Moderate	High
Overall Information Impact Level:		Moderate		

Attachment: N/A

SECURITY CATEGORIZATION IMPACT TABLE SUMMARY			
SECURITY OBJECTIVE	**LOW**	**MODERATE**	**HIGH**
Confidentiality	☐	☒	☐

Integrity	☐	☒	☐
Availability	☐	☐	☒

2.6 Mid-Level Solution Requirements

Attachment: Attachment 3 - CATMS Mid_Level_Requirements.pdf

Funding is available	Funding for CATMS will be available through District 4 State Highway Operation and Protection Program (SHOPP) funds for advanced transportation management systems.
Training	The system integrator will be responsible for the initial training for the 12 districts prior to implementation. Ongoing training will be conducted at the California State Polytechnic TMC Training Center.
Data from multiple systems can be converted to a common format and measurement	Data from the 12 TMCs can be input and stored in the new CATMS in a common format so that it can be used in analysis.
SME Availability	The various SMEs needed to complete the project will be available as scheduled.
Change Management and Governance	To acheive supportability the CATMS Change Control Board (CCB) will manage all change across the State. Below are strategies that will be implemented by the CCB to ensure commonality across the TMCs: 1. The COTS source code will not be made available and without the source code unauthorized changes will not be possible since changes would require the CATMS system integration vendor. 2. Districts will receive test and production environments to operate CATMS but will not receive development environments in their local infrastructure. The CATMS development environment will be managed at headquarter to effectively manage the flow of software enhancements. 3. Caltrans IT will control the provisioning of virtual machines (VMs) across the State. Any new VMs will be created by IT and, where applicable, evaluated by the CCB.
Interim Solution (ATMSR) Lessons Learned	Caltrans will be implementing an interim solution (ATMSR) prior to CATMS and will leverage lessons learned in data migration/conversion, configuration, and integration to improve CATMS implementation success.
Implementation	The solution will be implemented by a single system integrator working in collaboration with Caltrans staff.
Select + to add assumptions/constraints.	

2.8 Dependencies

Element	Description
n/a	n/a
Select + to add dependencies.	

2.9 Market Research

2.9.1 Market Research Methodologies/Timeframes

Methodologies Used To Perform Market Research (check all that apply):

☒	Request for Information (RFI)	☐	Trade shows
☒	Internet Research	☐	Published Literature
☒	Vendor Forums/Presentation	☐	Leveraged Agreements
☒	Collaboration with other Agencies/state entities or governmental entities	☐	Other, specify:

Time spent conducting market research:	7 months
Date market research was started:	8/22/2019 – Release of RFI
Date all market research was completed:	3/17/2020 – Date of Market Research attachment

2.9.2 Results of Market Research

To evaluate potential solutions available that could replace the legacy control systems managed by Caltrans, market research was conducted. Using stakeholder needs in the form of requirements the market research conducted for the California Advanced Transportation Management System (CATMS) project was created to identify viable solutions, determine rough order of magnitude estimates, define realistic timelines for implementation, and assess practical solutions types [e.g. Commercial Off the Shelf (COTS), Modified Off the Shelf (MOTS), or custom development]. The scope of the market research included a Request for Information (RFI) solicitation that required system integrator demonstration of key features and concluded with a detailed analysis of each system integrator's response which is captured in the attached market research document. The Market Research was also reviewed by the Caltrans Enterprise Architecture Committee and approved by the Caltrans IT Executive Council which substantiated the analysis conducted. The detailed analysis is included in this PAL Stage 2 submission under Attachment 4.

Attachment 4 - CATMS Market Research.pdf

2.10 Alternative Solutions

2.10.1 Solution Type

☒ **Recommended**

2.10.2 Name

CATMS COTS On-premise

2.10.3 Description

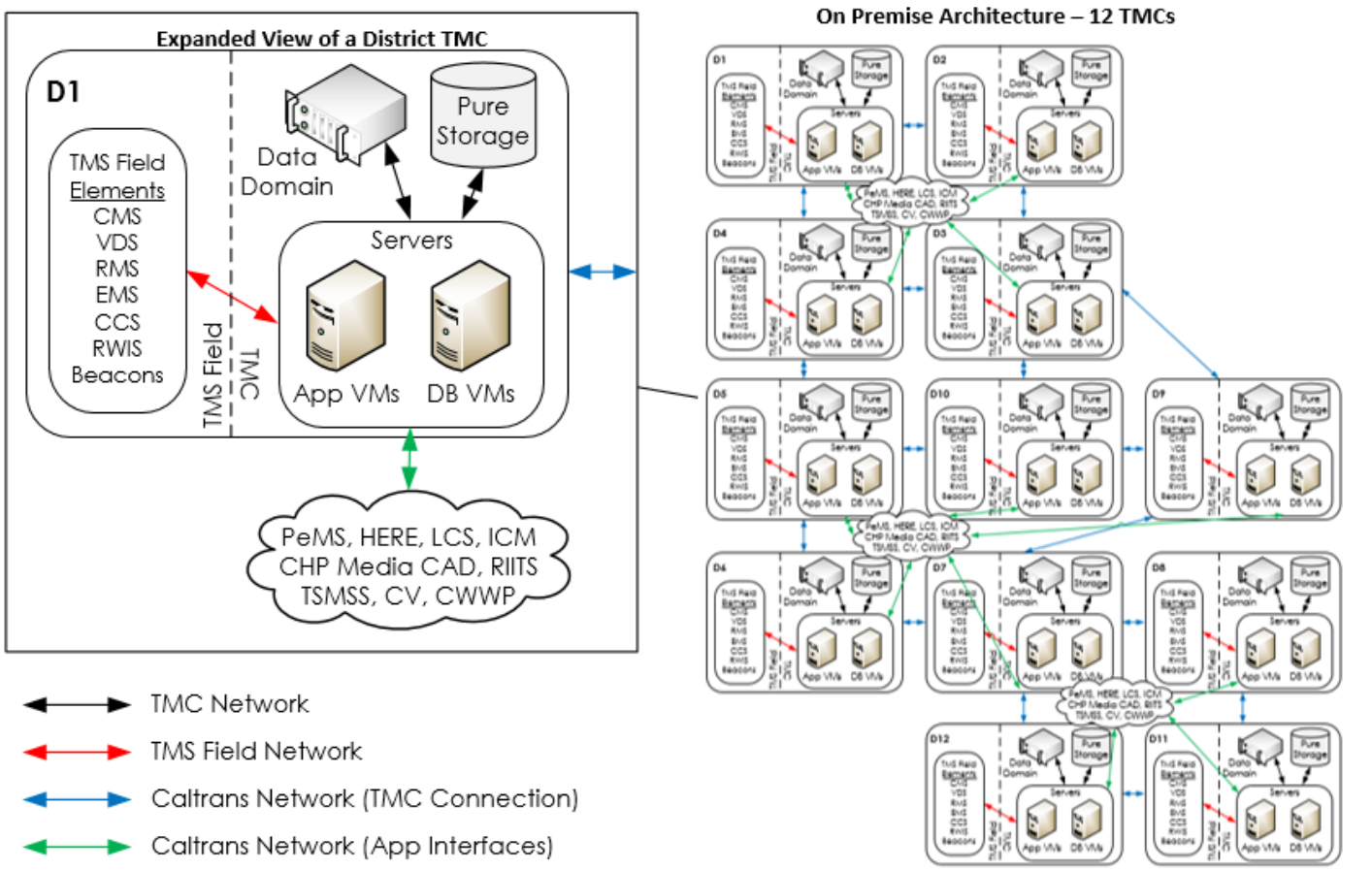
The recommended alternative for CATMS is a COTS On-premise solution and consists of both COTS application software and local infrastructure at each District TMC. The Market Research findings generated high confidence in the COTS solutions available in the marketplace where, on average, 75% of the State's requirements are met with COTS or configured/modified off the shelf components. The research also supports an alternative that consists of a COTS solution that is hosted on-premise at each of the 12 TMCs and maintained and supported by a system integrator maintenance contract.

COTS: As part of this alternative, Caltrans anticipates that the COTS application software selected will undergo modification and customization to address the needs across the four main business functional areas (TMC Operations, Ramp Metering Operations & Support, TMS Support, and Central Systems Support) and to meet the Objectives identified in Stage 1. Based on market research many of the COTS solutions offered by the vendor community will also be supported by on-premise infrastructure and can be deployed into virtual machine (VM) environments using a variety of database and operating system technologies.

On-premise: Infrastructure will be installed at each of the District TMCs across the State and will leverage interfaces between neighboring Districts to satisfy Objective 1.1 (e.g. remote access, relocation, and interoperability). Each District

TMC, with the exception of Districts that are already in multi-District computer rooms, will either leverage existing hardware and infrastructure purchased in 2019 or will require new equipment which contains the following core elements: servers, backup and recovery storage devices, and transactional storage devices. The core elements installed into the various Districts will also align with Caltrans' enterprise standards for the hardware types, configuration, and network setup. This architecture can scale to the needs of each Districts' TMC, for example, urban areas typically utilize more resources due to their traffic volume. Lastly, each TMC's infrastructure will also be configured in clusters to support Caltrans' high availability, redundancy, and recovery goals.

The diagram below depicts the system architecture for the CATMS COTS On-premise Solution.



The CATMS COTS On-premise system architecture consists of local infrastructure at each District TMC, TMC Network, TMS Field Network, Caltrans Network for TMC Connection, and Caltrans Networks for Application interfaces. The below section provides the highlights for each of these components.

Infrastructure: The CATMS COTS On-premise solution stores the COTS application and database instance at each of the 12 TMCs, enabling each District to operate independently, and act swiftly in an emergency situation without relying on a third-party vendor if network connectivity is lost. As depicted in the architecture diagram, multiple servers, application VMs, and database VMs are needed to support CATMS and the applications that currently exist in each TMC. Data domain, for backup and recovery, and PURE storage components are also needed at each TMC.

TMC Network: The black arrows depicted in the architecture diagram indicate the local application and database servers, data domain, and storage connections within each District. Many Districts have fully functional computer

rooms, maintenance IT teams, and technical staff to manage their equipment locally without reliance on third party vendors or IT.

TMS Field Network: The red arrows depicted in the architecture diagram indicate the physical connection between the TMS Field Elements and CATMS which is not redundant. A limitation across the State is that all of the field elements are funneled through physical access points at each respective TMC making field element functionality dependent on the access point within the TMC. The TMS Field elements provide TMC staff with valuable information such as traffic data, environmental warning information, and camera feeds, but also provides the critical capability of disseminating alerts to the traveling public through devices such as Highway Advisory Radio (HAR) and CMS.

Caltrans Network (TMC Connection): The blue arrows depicted in the architecture diagram indicate the communication that occurs between the various Districts to support Objective 1.1 (e.g. remote access, relocation, and interoperability). TMS Field Network configuration data needed to control District specific field elements will be replicated to neighboring Districts over this communication network. Database sizing and connectivity testing (inclusive of physical circuit geographical diversity) will be conducted to enable this functionality.

Caltrans Network (Application Interfaces): The green arrows depicted in the architecture diagram represent each district's application interface with the Caltrans Headquarters (HQ) network and external interfaces such as PeMS, Lane Closure System (LCS), and CWWP.

Approach (Check all that apply)**:**

☐	Increase staff – new or existing capabilities
☒	Modify the existing business process or create a new business process
☐	Reduce the services or level of services provided
☒	Utilize new or increased contracted services
☐	Enhance the existing IT system
☒	Create a new IT system
☐	Perform a business-based procurement to have vendors propose a solution
☒	Other, specify: CATMS will be a COTS solution that is hosted on existing TMC hardware.

2.10.4 Benefit Analysis

Benefits/Advantages

Listing of Benefits (bulleted list)

- The numerous COTS solutions in the marketplace makes it possible to select a COTS on-premise solution that is functional and effective for users without extensive modification by the system integrator.
- The risk of cost increases and schedule delays is reduced since much of the required functionality is already available in the marketplace; on average 75% of the State's initial requirements were met with COTS or configured/modified off the shelf components.
- Leverages past investments in on-premise TMC hardware (i.e. $10M was utilized in 2019 alone) that is implemented across various Districts; using this existing and newly purchased infrastructure reduces the overall hardware cost for the project.
- Aligns with the Caltrans District and HQ technical skillset, enabling control of their own infrastructure and systems. Therefore, the Districts will not be reliant on a network support vendor in an emergency.
- The Districts will be able to operate independently without network connectivity but can be controlled by others in an emergency event. The physical (fiber) connection to their field elements allows them to be self-sufficient and address any safety issues.
- Uses existing multi-District computer rooms where applicable to save on the overall infrastructure costs.

Select + to add benefits/advantages.

Disadvantages

Listing of disadvantages (bulleted list)

- Requires licensing costs for separate systems across the District TMCs.
- Requires additional support staff to manage the infrastructure and system.
- Requires a reliance on the system integrator to support the CATMS application.
- Network consistency across the 12 TMCs may prove to be difficult and will require additional IT support.
- Requires additional infrastructure to support high availability, geographical redundancy, and disaster recovery requirements in each TMC computer room.

Select + to add disadvantages.

Anticipated Time to Achieve Objectives After Project Go-Live

	Objective Timeframe				
Objective Number	**Within 1 Year**	**2 Years**	**3 Years**	**4 Years**	**Over 4 Years**
1.1	☒	☐	☐	☐	☐
2.1	☒	☐	☐	☐	☐
3.1	☐	☒	☐	☐	☐
4.1	☐	☒	☐	☐	☐
5.1	☒	☐	☐	☐	☐
6.1	☒	☐	☐	☐	☐

Select + to add objectives.

Anticipated Time to Achieve Financial Benefits After Project Go-Live

Financial Benefit	Within 1 Year	2 Years	3 Years	4 Years	Over 4 Years
Increased Revenues	☐	☐	☐	☐	☐
Cost Savings	☐	☐	☐	☐	☐
Cost Avoidance	☒	☐	☐	☐	☐
Cost Recovery	☐	☐	☐	☐	☐

2.10.5 Assumptions and Constraints

Cost avoidance consists of avoiding the cost of legacy licensing and maintenance costs for 12 individual systems that are nearing end of life and on extended/costly maintenance contracts.

The alternative will be implemented by a system integrator working with Caltrans staff. The system integrator will be responsible for providing, installing, and configuring the individual UI / transactional database components (modules).

The system integrator will be responsible for conversion and migrating of data from the current system databases to the new CATMS.

The system integrator will be responsible for maintenance and administration of the CATMS solution.

Select + to add assumptions/constraints

2.10.6 Implementation Approach

Identify the type of existing IT system enhancement or new system proposed (check all that apply)**:**

- ☐ Enhance the current system
- ☐ Develop a new custom solution
- ☒ Purchase a Commercial off-the-Shelf (COTS) system
- ☐ Purchase or obtain a system from another government agency (Transfer)
- ☐ Subscribe to a Software as a Service (SaaS) system
- ☐ Other, specify:

Identify cloud services to be leveraged (check all that apply)**:**

- ☐ Software as a Service (SaaS) provided by OTech
- ☐ Software as a Service (SaaS) provided by commercial vendor
- ☐ Platform as a Service (PaaS) provided by OTech
- ☐ Platform as a Service (PaaS) provided by commercial vendor

☐ Infrastructure as a Service (IaaS) provided by OTech
☐ Infrastructure as a Service (IaaS) provided by commercial vendor
☒ No cloud services will be leveraged by this alternative. Provide a description of why cloud services are not being leveraged:
The CATMS COTS On-premise solution will be hosted in existing local infrastructure for Districts 2, 3, 4, 5, 6, 7, 8, 11, and 12. District 1, 9, and 10 will be hosted out of existing multi-District computer rooms. Since all Districts TMCs are maintained and operated by Caltrans staff using their existing investment in on-premise solutions there is no need to implement CATMS in cloud infrastructure. Caltrans will leverage their existing infrastructure and not implement new cloud infrastructure since it isn't needed.

Identify who will modify the existing system or create the new system (check all that apply)**:**

☐ Agency/state entity IT staff
☒ A vendor will be contracted
☐ Inter-agency agreement will be established with another governmental agency. Specify Agency name(s):

☐ Other, specify:

Identify the implementation strategy:

☐ All requirements will be addressed in this proposed project in a single implementation.
☒ Requirements will be addressed in incremental implementations in this proposed project. TBD: Release 1 will implement core features and Release 2 will implement advanced features.
☐ Some requirements will be addressed in this proposed project. The remaining requirements will be addressed at a later date.
Specify the year when the remaining requirements will be addressed:

Identify if the technology for the proposed project will be mission critical and public facing:

☒ The technology implemented for this proposed project will be considered mission critical and public facing.

2.10.7 Architecture Information

Business Function/Process(es)	• Activity Logging • Automated Warning System • Performance & Mandated Reports • Ramp Metering • Central Systems Support Process • Traveler Information			
Select + to add a business process with the same application, system, or component; COTS, MOTS or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component	Vendor Provided Components			
	Select + to add an application, system, or component.			
COTS, MOTS or Custom	Commerical off-the-shelf (COTS)			
Name/Primary Technology:	Vendor Supplied			
Runtime Environment	Cloud Computing Used?	☐ Yes ☒ No	If "Yes," specify:	Select...
	Server/Device Function	See Requirements		
	Hardware	See Requirements		
	Operating System	See Requirements		
	System Software	See Requirements		
Select + to add system software.				
System Interfaces	• Transportation Management System (TMS) Field Elements • California Highway Patrol (CHP) Media Computer Aided Dispatch (CAD)			

		• Performance Measurement System (PeMS) • Commercial Wholesale Web Portal (CWWP2) • Lane Closure System (LCS) • Environmental Information Systems • Video Management Systems • Integrated Corridor Management (ICM) and Amazon Web Services (AWS) for District 7 ICM systems • Traffic Signal Management Surveillance Systems (TSMSS) • KITS Advanced Transportation Management System • Caltrans Highway Information Network (CHIN) • Arterial Management System • Sensys Networks Archive • Information Relays • Video Wall Systems (e.g. Activu, Video Decoder Control, Creston) • Travel Time Data Sources • Commercial Provided Traffic Data (e.g. HERE, INRIX, Waze) • RITTS • Managed Lanes Systems • Tunnel Management Systems • SCADA Systems • HAR Management Systems • Enterprise GIS Platform • County EOC Systems • Transit Systems • Linear Referencing System (LRS) • HQ SNOW (i.e. ServiceNow) • HQ Reporting Server (i.e. Tableau) • Truck Parking Availability System (TPAS)
Data Center Location	Other, specify	Agency/state data center operated by Agency/state entity Hosted in State computer rooms and is operated by the State.
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:
Data Management	Data Owner	Name, Title, Program: D1 – Sheri Rodriguez, Central Systems Functional Manager, Traffic Operations; D2 – Joe Baltazar, TMC Operations Functional Manager, Traffic Operations; D3 – Isam Tabshouri, TMC Operations Functional Manager, Traffic Operations; D4 – Ramin Bolourchian, TMC Operations Functional Manager, Traffic Operations; D5 – Roger Barnes, TMC Operations Manager, Traffic Operations; D6 – Joel Aguilar, TMC Operations Functional Manager, Traffic Operations; D7 – David Lau, TMC Operations Functional Manager, Traffic Operations; D8 – Yong Kim, TMC Operations Functional Manager, Traffic Operations; D9 – Lianne Talbot, TMC

		Operations Functional Manager, Traffic Operations; D10 – Wille Kuhl, TMC Operations Functional Manager, Traffic Operations; D11 – Margie Perez, TMC Operations Functional Manager, Traffic Operations; D12 – Saeed Nafisi, TMC Operations Functional Manager, Traffic Operations;
	Data Custodian	Name, Title, Program: D1 – Anthony Carnemolla, Central Systems Support, Traffic Operations; D2 – Keith Koeppen, Central Systems Support, Traffic Operations; D3 – Andres Chavez, Central Systems Functional Manager, Traffic Operations; D4 – Hector Garcia, Central Systems Functional Manager, Traffic Operations; D5 – Steven Gee, Central Systems Support, Traffic Operations; D6 – Sam Campos, Central Systems Functional Manager, Traffic Operations; D7 – Hung Tran, Central Systems Support, Traffic Operations; D8 – Rix Ng, Central Systems Support, Traffic Operations; D9 – Michael Cooper, IT Support, Information Technology; D10 – Arlene Cordero, Central Systems Support, Traffic Operations; D11 – Harrison Makau, Central Systems Support, Traffic Operations; D12 – Glenn Hayashida, Central Systems Support, Traffic Operations;

Select + to add business functions/processes.

2.10.1 Solution Type

☒ **Alternative**

2.10.2 Name

CATMS COTS Hybrid Cloud

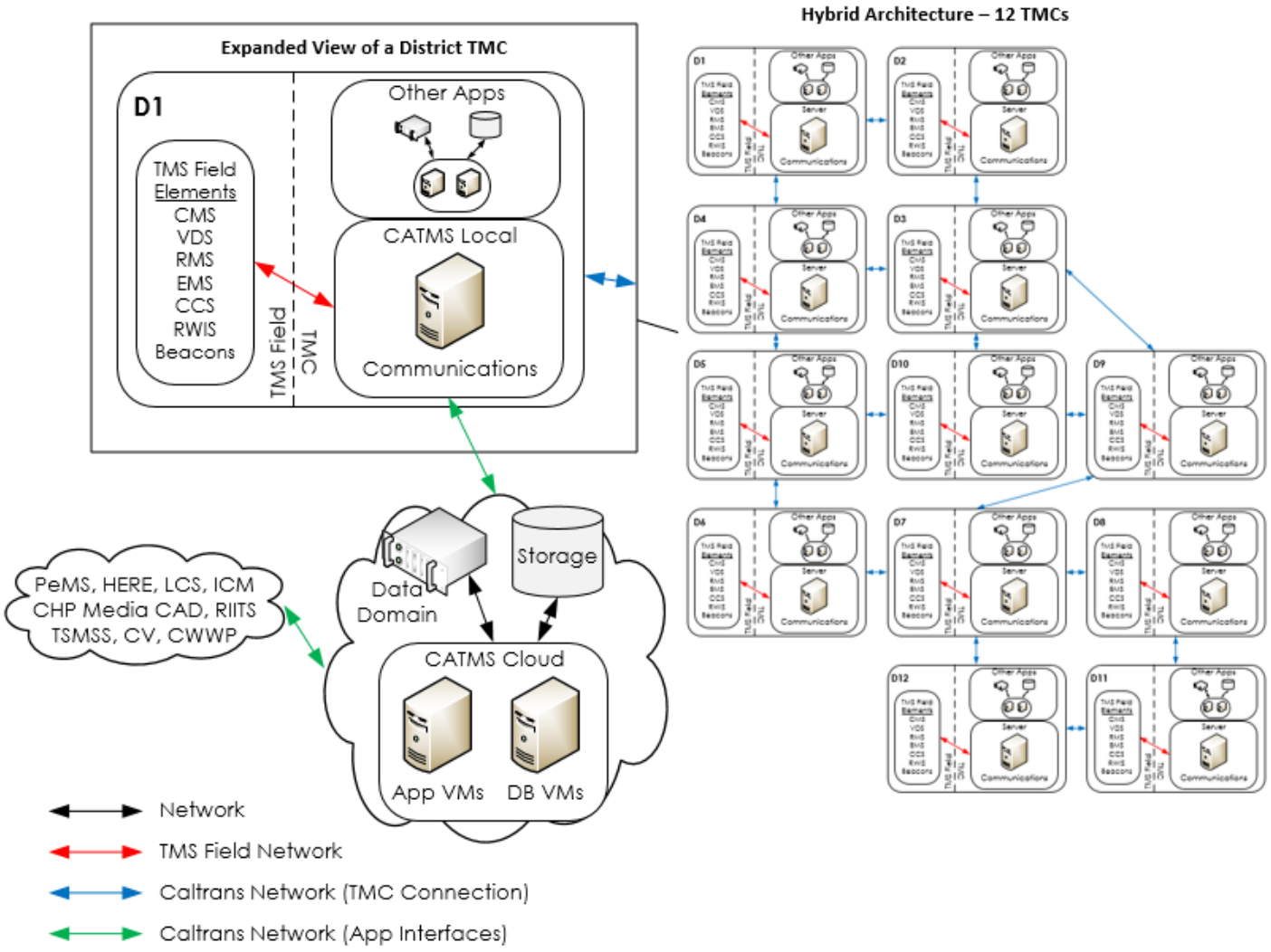
2.10.3 Description

This alternative for CATMS is a COTS Hybrid solution and consists of COTS application software, local communication servers at each District TMC, and a centralized cloud infrastructure. As stated in the recommended solution, Market Research findings generated high confidence in the COTS solutions available in the marketplace where, on average, 75% of the State's requirements are met with COTS or configured/modified off the shelf components. The research also supports an alternative that consists of a COTS solution that is hosted in cloud infrastructure and supported by the system integrator maintenance contract.

COTS: As identified in the recommended solution, Caltrans anticipates that the COTS application software selected will undergo modification and customization to address the needs across the four main business functional areas (TMC Operations, Ramp Metering Operations & Support, TMS Support, and Central Systems Support) and to meet the Objectives identified in Stage 1. Based on market research many of the COTS solutions offered by the vendor community will also be supported in cloud infrastructure and can be deployed into VM environments using a variety of database and operating system technologies. Furthermore, some vendors indicated their solution to be cloud native which could potentially eliminate the need to create multiple costly VMs in the cloud environment.

Hybrid Cloud: A core differentiator to the COTS on-premise alternative is that the COTS hybrid cloud alternative will require infrastructure in the cloud in addition to infrastructure at each of the District TMCs across the State. To satisfy Objective 1.1 (e.g. remote access, relocation, and interoperability) the application and database for CATMS will be hosted in the cloud so interface communication across the Districts will be centralized. Each District TMC will still require a local communications server to, at a minimum, transmit field element data to the cloud infrastructure. Also note that the TMC will have to maintain infrastructure for other applications running at the TMC aside from CATMS. With the application processing handled in the cloud the system can scale elastically to the needs of each Districts TMC to address resource variances. In addition, the cloud infrastructure can be configured to handle cross region replication to achieve Caltrans' high availability, redundancy, and recovery goals.

The diagram below depicts the system architecture for the CATMS COTS Hybrid Cloud Solution.



The CATMS COTS Hybrid Cloud system architecture consists of cloud infrastructure, local infrastructure at each District TMC, TMC Network, TMS Field Network, Caltrans Network for TMC Connection, and Caltrans Networks for Application interfaces. The section below provides the highlights of each of these components.

Cloud Infrastructure: The COTS application, database, and storage will be centralized in the cloud infrastructure to take advantage of features such as cross region replication to support disaster recovery, 99.999% (five 9's) availability, and elastic sizing capabilities to meet varying District needs. In the architecture diagram above there is a depiction of VMs within the cloud infrastructure but depending on the system integrators offering, a cloud native solution may be proposed.

Local Infrastructure: Although the COTS solution will be hosted in cloud infrastructure for this alternative there is still a need for local infrastructure in each of the District TMCs. As indicated in the TMS field network section below, there is a physical connection between the field elements and the TMC. These field elements are not capable of sending and receiving information to the cloud which is the reason why local infrastructure where the communication feed is received must be retained. Furthermore, multiple servers, application VMs, and database VMs are needed to support other applications that currently exist in each TMC. Data domain, for backup and recovery, and PURE storage components are also needed at each TMC to support applications aside from CATMS.

Network: The black arrows depicted in the architecture diagram indicate the application and database servers, data domain, and storage connections within the cloud. Since many Districts have fully functional local computer rooms, maintenance and IT teams, and technical staff to manage their local equipment there may be a reliance on third party vendors or consulting staff to supplement the department with specific cloud maintenance expertise.

TMS Field Network: The red arrows depicted in the architecture diagram indicate the physical connection between the TMS Field Elements and the District TMC which is not redundant. As identified in the COTS on-premise alternative, a limitation across the State is that all of the field elements are funneled through physical access points at each respective TMC making field element functionality dependent on the access point within the TMC. The TMS Field elements provide TMC staff with valuable information such as traffic data, environmental warning information, and camera feeds, but also provides the critical capability of disseminating alerts to the traveling public through devices such as HAR and CMS.

Caltrans Network (TMC Connection): The blue arrows depicted in the architecture diagram indicate the communication that occurs between the various Districts but would no longer be needed to support Objective 1.1 (e.g. remote access, relocation, and interoperability) since CATMS will be hosted in the cloud. TMS Field Network configuration data needed to control District specific field elements will be managed in the cloud. Therefore, replication to neighboring Districts is no longer needed for CATMS. Aside from CATMS, the connection may still need to be maintained to support other TMC functions not related to the CATMS project.

Caltrans Network (Application Interfaces): The green arrows depicted in the architecture diagram represent each District's application interface with the Caltrans Headquarters (HQ) network and external interfaces such as PeMS, LCS, and CWWP2. Modifications to network, firewall, and other security items will be needed to direct the current interfaces from the existing TMC hardware to the cloud.

Approach (Check all that apply)**:**	
☐	Increase staff – new or existing capabilities
☒	Modify the existing business process or create a new business process
☐	Reduce the services or level of services provided
☒	Utilize new or increased contracted services
☐	Enhance the existing IT system
☒	Create a new IT system
☐	Perform a business-based procurement to have vendors propose a solution
☐	Other, specify:

2.10.4 Benefit Analysis

Benefits/Advantages

- The numerous COTS solutions in the marketplace makes it possible to select a COTS Hybrid Cloud solution that is functional and effective for users without extensive modification by the system integrator.
- The risk of cost increases and schedule delays is reduced since much of the required functionality is already available in the marketplace; on average 75% of the State's initial requirements were met with COTS or configured/modified off the shelf components.
- Depending on the system integrator's offering less Caltrans support may be needed. If the system integrator offers a Software as a Service (SaaS) product then there will be less Caltrans maintenance involvement. This advantage is also a disadvantage if the offering is not SaaS.
- Reduces the CATMS maintenance and licensing costs associated with separate systems.
- Possesses built in Disaster Recovery and High Availability support using cloud services.

Select + to add benefits/advantages

Disadvantages

Listing of disadvantages (bulleted list)

- Does not allow the TMCs to control CATMS locally using their existing on-premise hardware. Requires a reliance on the system integrator and the cloud vendor for network support.
- Requires reliance on IT WAN team and ISP network providers for inter-district and ISP data circuits that could be compromised, or services reduced, during a castastrophic event. Adds additional risk of potentially orphaning districts with no means of controlling field elements in catastrophic events. With the current on premise TMC implementations field elements can be controlled regardless of network connection since there is a physical connection from the TMC to the field elements.
- Requires additional IT roles and skillsets that possess cloud infrastructure skills .
- Higher cost associated with cloud infrastructure and services as documented in the Financial Analysis Worksheet.
- Higher costs associated with data bandwidth (e.g. live streaming video to monitor the California infrastructure and events or incidents).
- Utilizing one centralized database may prove difficult since this requires normalizing the data across all districts and increased data ownership and governance.
- May limit the vendor pool and exclude vendors that only have an On premise solution.
- Existing TMC applications may not be supported in the cloud which would still require on-premise hardware and duplicative costs for hardware, software, computer room management, and technical staff.

Select + to add disadvantages

Anticipated Time to Achieve Objectives After Project Go-Live

Objective Number	Objective Timeframe: Within 1 Year	2 Years	3 Years	4 Years	Over 4 Years
1.1	☒	☐	☐	☐	☐
2.1	☒	☐	☐	☐	☐
3.1	☐	☒	☐	☐	☐
4.1	☐	☒	☐	☐	☐
5.1	☒	☐	☐	☐	☐
6.1	☒	☐	☐	☐	☐

Select + to add objectives

Anticipated Time to Achieve Financial Benefits After Project Go-Live

Financial Benefit	Within 1 Year	2 Years	3 Years	4 Years	Over 4 Years
Increased Revenues	☐	☐	☐	☐	☐
Cost Savings	☐	☐	☐	☐	☐
Cost Avoidance	☐	☐	☐	☐	☐
Cost Recovery	☐	☐	☐	☐	☐

2.10.5 Assumptions and Constraints

The system integrator will be responsible for maintenance and administration of the CATMS solution.
The alternative will be implemented by a system integrator working with Caltrans staff. The system integrator will be responsible for providing, installing, and configuring the individual UI / transactional database components (modules).
The system integrator will be responsible for conversion and migrating of data from the current system databases to the new CATMS.

Select + to add assumptions/constraints

2.10.6 Implementation Approach

Identify the type of existing IT system enhancement or new system proposed (check all that apply)**:**

- ☐ Enhance the current system
- ☐ Develop a new custom solution
- ☒ Purchase a Commercial off-the-Shelf (COTS) system
- ☐ Purchase or obtain a system from another government agency (Transfer)
- ☐ Subscribe to a Software as a Service (SaaS) system
- ☐ Other, specify:

Identify cloud services to be leveraged (check all that apply)**:**

- ☐ Software as a Service (SaaS) provided by OTech
- ☐ Software as a Service (SaaS) provided by commercial vendor
- ☐ Platform as a Service (PaaS) provided by OTech
- ☒ Platform as a Service (PaaS) provided by commercial vendor
- ☐ Infrastructure as a Service (IaaS) provided by OTech
- ☒ Infrastructure as a Service (IaaS) provided by commercial vendor
- ☐ No cloud services will be leveraged by this alternative. Provide a description of why cloud services are not being leveraged:

Identify who will modify the existing system or create the new system (check all that apply)**:**

- ☐ Agency/state entity IT staff
- ☒ A vendor will be contracted
- ☐ Inter-agency agreement will be established with another governmental agency. Specify Agency name(s):

- ☐ Other, specify:

Identify the implementation strategy:

- ☐ All requirements will be addressed in this proposed project in a single implementation.
- ☒ Requirements will be addressed in incremental implementations in this proposed project. TBD: Release 1 will implement core features and Release 2 will implement advanced features.
- ☐ Some requirements will be addressed in this proposed project. The remaining requirements will be addressed at a later date.

  Specify the year when the remaining requirements will be addressed:

Identify if the technology for the proposed project will be mission critical and public facing:

- ☒ The technology implemented for this proposed project will be considered mission critical and public facing.

2.10.7 Architecture Information

Business Function/Process(es)	• Activity Logging • Automated Warning System • Performance & Mandated Reports • Ramp Metering • Central Systems Support Process • Traveler Information			
Select + to add a business process with the same application, system, or component; COTS, MOTS or custom solution; runtime environment; system interfaces, data center location; and, security.				
Application, System or Component	Vendor Provided Components			
	Select + to add an application, system, or component.			
COTS, MOTS or Custom	Commerical off-the-shelf (COTS)			
Name/Primary Technology:	Vendor Supplied			
Runtime Environment	Cloud Computing Used?	☒ Yes ☐ No	If "Yes," specify:	Platform as a Service (PaaS)
	Server/Device Function	See Requirements		
	Hardware	See Requirements		

	Operating System	See Requirements
	System Software	See Requirements
Select + to add system software		
System Interfaces		• Transportation Management System (TMS) Field Elements • California Highway Patrol (CHP) Media Computer Aided Dispatch (CAD) • Performance Measurement System (PeMS) • Commercial Wholesale Web Portal (CWWP) • Lane Closure System (LCS) • Environmental Information Systems • Video Management Systems • Integrated Corridor Management (ICM) and Amazon Web Services (AWS) for District 7 ICM systems • Traffic Signal Management Surveillance Systems (TSMSS) • KITS Advanced Transportation Management System • Caltrans Highway Information Network (CHIN) • Arterial Management System • Sensys Networks Archive • Information Relays • Video Wall Systems (e.g. Activu, Video Decoder Control, Creston) • Travel Time Data Sources • Commercial Provided Traffic Data (e.g. HERE, INRIX, Waze) • RITTS • Managed Lanes Systems • Tunnel Management Systems • SCADA Systems • HAR Management Systems • Enterprise GIS Platform • County EOC Systems • Transit Systems • Linear Referencing System (LRS) • HQ ServiceNow (SNOW) • HQ Reporting Server (i.e. Tableau) • Truck Parking Availability System (TPAS)
Data Center Location	Other, specify	State data center operated by department of Technology
Security	Access (check all that apply)	☐ Public ☒ Internal State Staff ☐ External State Staff ☐ Other, specify:
	Type of Information (check all that apply)	☐ Personal ☐ Health ☐ Tax ☐ Financial ☐ Legal ☐ Confidential ☐ Other, specify:
	Protective Measures (check all that apply)	☒ Technical Security ☒ Identity Authorization and Authentication ☒ Physical Security ☒Backup and Recovery ☐ Other, specify:
Data Management	Data Owner	Name, Title, Program: D1 – Sheri Rodriguez, Central Systems Functional Manager, Traffic Operations; D2 – Bill Sutherland (Acting), TMC Operations Functional Manager, Traffic Operations; D3 – Isam

		Tabshouri, TMC Operations Functional Manager, Traffic Operations; D4 – Ramin Bolourchian, TMC Operations Functional Manager, Traffic Operations; D5 – Roger Barnes, TMC Operations Manager, Traffic Operations; D6 – Joel Aguilar, TMC Operations Functional Manager, Traffic Operations; D7 – David Lau, TMC Operations Functional Manager, Traffic Operations; D8 – Yong Kim, TMC Operations Functional Manager, Traffic Operations; D9 – Lianne Talbot, TMC Operations Functional Manager, Traffic Operations; D10 – Wille Kuhl, TMC Operations Functional Manager, Traffic Operations; D11 – Margie Perez, TMC Operations Functional Manager, Traffic Operations; D12 – Saeed Nafisi, TMC Operations Functional Manager, Traffic Operations
	Data Custodian	Name, Title, Program: D1 – Anthony Carnemolla, Central Systems Support, Traffic Operations; D2 – Keith Koeppen, Central Systems Support, Traffic Operations; D3 – Andres Chavez, Central Systems Functional Manager, Traffic Operations; D4 – Hector Garcia, Central Systems Functional Manager, Traffic Operations; D5 – Steven Gee, Central Systems Support, Traffic Operations; D6 – Sam Campos, Central Systems Functional Manager, Traffic Operations; D7 – Hung Tran, Central Systems Support, Traffic Operations; D8 – Rix Ng, Central Systems Support, Traffic Operations; D9 – Michael Cooper, IT Support, Information Technology; D10 – Arlene Cordero, Central Systems Support, Traffic Operations; D11 – Harrison Makau, Central Systems Support, Traffic Operations; D12 – Glenn Hayashida, Central Systems Support, Traffic Operations

Select + to add business functions/processes

2.11 Recommended Solution

2.11.1 Rationale for Selection

The Recommended Solution is the COTS on-premise solution since it will provide the greatest value for the state while meeting the projects objectives. The recommended solution will meet the business objectives, align with Caltrans skillset, and allow for safe and independent function in an emergency event all while lowering the risk of implementation and challenges in operations. The following sections expand on how the recommended solution meets the objectives, describes why the disadvantages are not significant, compares the alternatives, and confirms the procurement feasibility.

Meeting Business Objectives and Requirements

The recommended solution meets the business objectives and detailed requirements as identified in the Market Research. Vendors who responded to the request for information (RFI) indicated that, on average, 75% of more than 1000 requirements could be addressed through their COTS or MOTS offering. With these requirements clearly communicating the functional needs for the department there is a consensus that a COTS product is viable for the CATMS project. Furthermore, many vendors indicated that an on-premise solution would be a recommended approach for the implementation of their product offering.

Benefits and advantages of the recommended solution include:

1. High Value – based on the Market Research and our internet research COTS vendors are implementing cutting edge features throughout their worldwide customer base. Using a COTS solution will allow Caltrans to take advantages of a continuous flow of innovation that a COTS package can provide. Essentially, as the system integrator implements beneficial changes across the world, Caltrans will be able to take advantage. In addition, there were 11 vendor responses to the RFI which indicates there are many COTS offerings in the marketplace. Since there are many vendors that have a high interest in this project there will be substantial competition. With a highly competitive environment Caltrans will have the opportunity to select a solution at the highest

value possible with a feature set beyond the state's current development capabilities. Requirements will be categorized as mandatory and desirable to take advantage of this situation. The procurement scoring will be weighted in favor to the vendor that meets both the mandatory and the most Desirable requirements. Essentially, with increased competition in the marketplace there is a high likelihood that the winning respondent will have a solution that addresses a high number of Desirable requirements within the state's budgetary constraints.

2. Safe Independent Operation – the Districts will be able to operate the TMCs independently without network connectivity since the infrastructure and the CATMS solution will be on-premise and directly connected, via existing infrastructure, to the field elements used to manage traffic. Having no reliance on the wide area network, Internet Service Provider (ISP), or a cloud vendor allows Districts to be able to manage infrastructure in an emergency event which increases the safety of the motoring public.
3. Less Risk – risk of cost increases and schedule delays will be reduced since much of the required functionality is already available in the COTS offerings that are in the marketplace. Leveraging a COTS solution will take advantage of the existing features available and allow the system integrator to focus on configuration and advanced functionality development. Additionally, with an on-premise implementation of a COTS solution Caltrans envisions that there will less risk since the current infrastructure, network, and security components in the various District TMCs is well established.
4. Resource Skill Alignment – Both Caltrans District and IT resources have a vast degree of experience managing infrastructure, technical acumen to support hardware and software, and the tools to manage on-premise infrastructures. The recommended solution takes advantage of Caltrans investment in human capital and puts their skills to direct use without additional training. This also enables Districts and Caltrans IT to control of their own infrastructure and systems so that they are not reliant on another vendor in an emergency.
5. Supports Multi-District computer rooms – Although most Districts will utilize local infrastructure at their TMC a few will choose to operate out of a neighboring District to reduce hardware and staffing costs. Districts 1, 9, and 10 are already operating out of nearby District's computer room and will continue to operate in that fashion going forward since the connectivity and infrastructure is already established. Because CATMS will leverage a common platform it will have the flexibility to allow these Districts to take advantage of a multi-District computer room model as a way to lower costs.
6. Existing Investment – Caltrans has invested greatly in the network and infrastructure across the state and has created a well-established infrastructure in across the TMCs over the past decades. For example, in 2019 alone an investment over $10M was made for on-premise TMC hardware that is implemented across various Districts. In addition, and as depicted in the Attachment 10 - CATMS Financial Analysis Worksheets, additional hardware isn't anticipated to support the recommended solution and Caltrans will be reducing the number of maintenance contracts needed to support the existing legacy ITS solutions at the TMCs when the 12 legacy systems are decommissioned after CATMS implementation. The recommended solution will take advantage of system decommissioning and prior hardware investments which will allow the state to reduce the project's hardware and maintenance costs.

Disadvantages of Recommended Solutions

The recommended solution does have disadvantages, but none of them eliminate the solution or promote other alternatives. Details on the disadvantages and their impacts to being the recommended solution are listed below.

1. Local Hardware Management – since the recommended solution will require local infrastructure at each of the various TMCs support for the hardware and software will be more complex.
    a. Selection Impact: Although management of infrastructure at multiple locations is inherently more complex then managing one location it is not a unique model for Caltrans. Caltrans IT has experience managing maintenance across the enterprise and will be involved in the CATMS project throughout its lifecycle. As part of this project an addendum will be added to an existing memorandum of understanding (MOU) between Caltrans Traffic Operation and Caltrans IT to confirm the project implementation and maintenance and operations support required for CATMS.
2. Network Management – achieving a state-wide network topology that is easily supported across the 12 Districts will be critical for achieving the CATMS interoperability objective and for meeting the Disaster Recovery and

High Availability requirements. Although the network is in place across California, adjustments will be needed to increase supportability and those adjustments will require both business and technical input which can prove to be time consuming.

   a. Selection Impact: The CATMS project team understands that creating a supportable network topology will be complex since the California network used for the TMCs has been built and updated over the past decades, but it's also understood that any alternative solution will need to work in the confines of this architectural construct as well. Caltrans acknowledges this complexity and is already creating a network topology that can improve supportability across the state.

3. Business Continuity – California TMCs operate 24 hours and 7 days a week to properly manage the state's roadways and maintain a safe environment for the motoring public which is why continuous operation is key. To support the CATMS disaster recovery and high availability requirements additional infrastructure will be needed at relocation sites and/or neighboring Districts so that a TMC can failover to an alternate location in the event of an emergency.
   a. Selection Impact: Additional hardware and software will be needed to support the CATMS disaster recovery and high availability requirements. Initial evaluations indicate that data replication to support business continuity is one of the key driving factors for additional infrastructure and the data volume is expected to be low since only configuration data is required to properly manage TMS field elements at each District TMC. With low data volumes additional database capacity and licenses at the alternative sites should only be a minor challenge to overcome.
4. System integrator reliance – since the product is a COTS solution there will be a reliance on the system integrator to support CATMS.
   a. Selection Impact: Having a COTS solution lowers the risk of implementation while providing substantial benefits to Caltrans, but also puts a reliance on the system integrator for support of the product. As part of the contract Caltrans will include additional years of maintenance for the system integrator to provide support. This disadvantage is also true for the alternative solution but based on the Market Research results the benefits of COTS outweigh this disadvantage.

Recommended Solution compared to the Alternative Solution

Both alternatives will leverage a COTS package since the Market Research indicated that it is viable, and since Caltrans will benefit from advanced features that are readily available and that would take a large effort to replicate in a custom in-house built solution. The key difference between the recommended solution and the alternative solution is where the CATMS solution will be hosted. The recommended solution has CATMS hosted out of each of the District TMCs and the Alternative Solution has CATMS hosted out of cloud infrastructure with local communication servers at each of the TMCs.

To compare the alternatives Caltrans evaluated the following factor categories: capabilities, risk, alignment with Caltrans, and market availability. A brief description of the factors under each of these categories is documented below:

<u>Capabilities</u>

1. Objective alignment – indicates how well an alternative meets the project objectives and business need.
2. Independent Operation – evaluates how well the alternative will achieve independent and safe operations regardless of network connectivity.
3. Low Latency – assesses how quick an alternative can respond and evaluate data received from field elements since many operations in the TMC require immediate response to be effective.
4. Business Continuity – determines the robustness and low complexity of the disaster recovery and high availability approach across the alternatives.

<u>Risk</u>

1. Business Process Alignment – evaluates if there is any risk to aligning with the business processes.
2. Schedule / Implementation – indicates which alternative is least risky with regards to the timeline.
3. Maintenance and Operation – assesses which alternative has less challenges and less additional resource capabilities needed after project implementation.

<u>Alignment with Caltrans</u>

1. Network Compatibility – identifies which alternative will directly align with the existing Caltrans network and which will require changes in terms of firewall and port connectivity to field elements, headquarter systems, and external interfaces.
2. Data Governance – highlights the alternative that requires the most changes to properly maintain the solutions data repository, data dictionary, and data model.
3. Resource Skills – indicates which alternative has better alignment with the current Caltrans resource skillsets.

Market Availability

1. Available competition – as derived from the Market Research identifies which alternative had more competitors available in the marketplace.
2. Ease of Management – evaluates which alternative will require a lower number of contracts and result in easier contract management.

The table below depicts a side by side assessment of the Recommended Solution and the Alternative Solution based upon the categories and factors above. Cost was not included in this portion of the assessment since it is analyzed in the financial worksheets. Each factor is ranked from high to low, with high being the most suitable. The scoring is then normalized where High = 3, Medium = 2, Low = 1. Although most of the scoring is intuitive please note that for the Risk category a "high" represent the least risk. The scores are then totaled to yield a composite average to identify the State's best alternative. The scoring result suggests that the Recommended Solution is the best choice for the CATMS project.

	COTS On-Premise	**COTS Hybrid Cloud**
Capabilities		
Objective alignment	High	High
Independent Operation	High	Medium
Low Latency	High	Medium
Business Continuity	Low	High
Risk (High = Least Risk)		
Business Process Alignment	High	High
Schedule / Implementation	High	Medium
Maintenance and Operations	High	Low
Alignment with Caltrans		
Network Compatibility	High	Medium
Data Governance	Medium	Low
Resource Skills	High	Low
Market Availability		
Available competition	High	Medium
Ease of management	Medium	High
Composite Average (High=3, Medium=2, Low=1	2.67	2.08

Procurement Factors and Procurement Feasibility

For procuring the CATMS solution, Caltrans IT, Caltrans Division of Procurement and Contract (DPAC), and CDT STP staff have extensive experience and the contract templates necessary to procure a systems integrator. Based on this experience, and at the recommendation of CDT, a collaborative effort between Caltrans IT, DPAC, and CDT STP will be conducted to release a pre-solicitation. By conducting a pre-solicitation, Caltrans expects to receive feedback from the vendor community that will strengthen the future contract, cost estimates, schedule estimates, statement of work, and the detailed requirements.

After a COTS solution is selected through a procurement, Caltrans Traffic Operations and Caltrans IT will coordinate with the winning system integrator to purchase any additional hardware that may needed to support CATMS, but Caltrans anticipates that additional purchases are not likely since TMCs already have capacity due to ongoing TMC Maintenance and Lifecycle Replacement activities. Aiding in procurement feasibility is the fact that Caltrans IT has an approved vendor list, standard products that are used in their enterprise systems, and a framework for architecture approval. With this expertise Caltrans is confident that the procurement of a system integrator and installation of any additional infrastructure to support an on-premise implementation of CATMS will be feasible.

In summary, both the procurement of a COTS solution and the implementation of on-premise infrastructure are feasible. The vendor community has a strong stable of product offerings that meet California's needs and Caltrans has the skills and architectural review framework to effectively purchase and implement the infrastructure required making the Recommended Solution the best alternative for CATMS procurement.

Attachment: n/a

2.11.2 Technical/Initial CA-PMM Complexity Assessment

Complexity		Complexity Zone		
Technical Complexity Score:	2.3	☐	Zone I	Low Criticality/Risk
		☒	Zone II/III	Medium Criticality/Risk
		☐	Zone IV	High Criticality/Risk

2.11.3 Procurement and Staffing Strategy

Activity

Solicitation Development and Cost Estimating

Responsible (check all that apply)	When Needed (check all that apply)	Cost Estimate Verification (check all that apply)
☒ Agency/state entity staff ☒ STP staff ☒ CDT Project Approvals and Oversight staff ☐ CA-PMO staff ☐ DGS staff ☒ Contractor ☐ Other, specify:	☒ Stage 3 Solution Development ☒ Stage 4 Project Readiness and Approval ☐ After project is approved (after Stage 4 Project Readiness and Approval)	☒ Market research conducted (MR) ☒ Cost estimate provided (CE) ☐ CDT CE ☐ DGS CE ☒ Request for Information (RFI) conducted ☒ Comparable vendor services have been used on previous contracts (CV) ☐ Leveraged Procurement Agreement (LPA)

Complete Only if Contractor Responsible for Activity

Procurement Vehicle	Request for Offer/Master Service Agreement (RFO/MSA)	**Contract Type**	Fixed Price (FP)
If "Other," specify:	Note: PAL Contractor (Cambria Solutions) will support these activities under their existing contract. No additional contract will be needed.	If "Other," specify:	

Conduct Procurement

Responsible (check all that apply)	When Needed (check all that apply)	Cost Estimate Verification (check all that apply)

☒ Agency/state entity staff ☒ STP staff CDT Project Approvals and Oversight staff ☐ CA-PMO staff ☐ DGS staff ☐ Contractor ☐ Other, specify:	☒ Stage 3 Solution Development ☒ Stage 4 Project Readiness and Approval ☐ After project is approved (after Stage 4 Project Readiness and Approval)	☐ Market research conducted (MR) ☐ Cost estimate provided (CE) ☒ CDT CE ☐ DGS CE ☐ Request for Information (RFI) conducted ☐ Comparable vendor services have been used on previous contracts (CV) ☐ Leveraged Procurement Agreement (LPA)

Complete Only if Contractor Responsible for Activity			
Procurement Vehicle		**Contract Type**	
If "Other," specify:	Click here to enter text.	If "Other," specify:	Click here to enter text.

Project Oversight

Responsible (check all that apply)	**When Needed** (check all that apply)	**Cost Estimate Verification** (check all that apply)
☒ Agency/state entity staff ☐ STP staff ☒ CDT Project Approvals and Oversight staff ☐ CA-PMO staff ☐ DGS staff ☐ Contractor ☐ Other, specify:	☐ Stage 3 Solution Development ☒ Stage 4 Project Readiness and Approval ☒ After project is approved (after Stage 4 Project Readiness and Approval)	☐ Market research conducted (MR) ☒ Cost estimate provided (CE) ☐ CDT CE ☐ DGS CE ☐ Request for Information (RFI) conducted ☐ Comparable vendor services have been used on previous contracts (CV) ☐ Leveraged Procurement Agreement (LPA)

Complete Only if Contractor Responsible for Activity			
Procurement Vehicle		**Contract Type**	
If "Other," specify:	Click here to enter text.	If "Other," specify:	Click here to enter text.

Independent Verification and Validation (IV&V)

Responsible (check all that apply)	**When Needed** (check all that apply)	**Cost Estimate Verification** (check all that apply)
☐ Agency/state entity staff ☐ STP staff ☐ CDT Project Approvals and Oversight staff ☐ CA-PMO staff ☐ DGS staff ☒ Contractor ☐ Other, specify:	☐ Stage 3 Solution Development ☐ Stage 4 Project Readiness and Approval ☒ After project is approved (after Stage 4 Project Readiness and Approval)	☐ Market research conducted (MR) ☒ Cost estimate provided (CE) ☐ CDT CE ☐ DGS CE ☐ Request for Information (RFI) conducted ☒ Comparable vendor services have been used on previous contracts (CV) ☐ Leveraged Procurement Agreement (LPA)

Complete Only if Contractor Responsible for Activity			
Procurement Vehicle	Request for Offer/Master Service Agreement (RFO/MSA)	**Contract Type**	Fixed Price (FP)

If "Other," specify:	Click here to enter text.	If "Other," specify:	Click here to enter text.

Systems Integration

Responsible (check all that apply)	When Needed (check all that apply)	Cost Estimate Verification (check all that apply)
☒ Agency/state entity staff ☐ STP staff ☐ CDT Project Approvals and Oversight staff ☐ CA-PMO staff ☐ DGS staff ☒ Contractor ☐ Other, specify:	☐ Stage 3 Solution Development ☐ Stage 4 Project Readiness and Approval ☒ After project is approved (after Stage 4 Project Readiness and Approval)	☒ Market research conducted (MR) ☒ Cost estimate provided (CE) ☐ CDT CE ☐ DGS CE ☐ Request for Information (RFI) conducted ☐ Comparable vendor services have been used on previous contracts (CV) ☒ Leveraged Procurement Agreement (LPA)

Complete Only if Contractor Responsible for Activity

Procurement Vehicle	Formal Solicitation (IFB/ RFP)	**Contract Type**	Fixed Price (FP)
If "Other," specify:	Note: Contract will support the following project aspects: Project Management, Requirements Elicitation, Business Analysis, Technical Analysis, Design, Integration/Development, Testing, OCM, Training, Data Cleansing/ Validation/ Conversion/ Migration, Enterprise Architecture, QA, Technical Installation Hardware/ Software, Maintenance, and Operations.	If "Other," specify:	Click here to enter text.

Contract Management

Responsible (check all that apply)	When Needed (check all that apply)	Cost Estimate Verification (check all that apply)
☒ Agency/state entity staff ☐ STP staff ☐ CDT Project Approvals and Oversight staff ☐ CA-PMO staff ☐ DGS staff ☐ Contractor ☐ Other, specify:	☐ Stage 3 Solution Development ☒ Stage 4 Project Readiness and Approval ☒ After project is approved (after Stage 4 Project Readiness and Approval)	☐ Market research conducted (MR) ☒ Cost estimate provided (CE) ☐ CDT CE ☐ DGS CE ☐ Request for Information (RFI) conducted ☐ Comparable vendor services have been used on previous contracts (CV) ☐ Leveraged Procurement Agreement (LPA)

Complete Only if Contractor Responsible for Activity

Procurement Vehicle		**Contract Type**	
If "Other," specify:	Click here to enter text.	If "Other," specify:	Click here to enter text.

Select + to add activities.

	Yes	No
Will any of the activities identified above result in a competitive or non-competitive solicitation that will be over the Agency/state entity's DGS delegated purchasing authority?	☒	☐

2.11.4 Enterprise Architecture Alignment

As part of the RFI, Caltrans provided server, storage, database, and software standards to the vendor community and there were no concerns expressed. In general, the COTS products in the marketplace are well supported across a variety of platforms and technologies which creates flexibility for Caltrans to enforce enterprise standards for CATMS and maintain consistency across their ecosystem. Caltrans IT will maximize their staffing skillsets for maintenance by having CATMS conform to standards for hardware, virtual machine implementation, and network topology.

Caltrans will implement CATMS across the Districts using standard hardware with the application housed within virtual machines. Although in some instances the physical hardware may reside on District managed networks, the CATMS application virtual machine instances will reside on the Caltrans IT network to align with the the Caltrans' enterprise approach for managing systems throughout the State. Since the vendor community can support virtual machine implementation and a variety of technologies Caltrans is confident that the recommended solution will align with their Enterprise Architecture and result in lower maintenance effot.

The recommended CATMS solution is a COTS product that will meet the project objectives and satisfy functional business needs. In some areas, Caltrans will employ the use of enterprise functionality to support the CATMS Rather then building new components with CATMS, Caltrans will leverage the following enterprise capabilities:
1. Public or Internet Portal/Website
2. Identity and Access Management (both per Caltrans requirements)
3. Business Intelligence and Data Warehousing (data and reporting will be incorporated into the PeMS database and reporting solution)
4. Enterprise Service Bus via CWWP for traveler information data sharing

Enterprise capabilities that will not be used by CATMS in the intial project delivery are:
1. Public or Internal Mobile Application
2. Enterprise Content Management
3. Master Data Management
4. Big Data Analytics

Information Technology Capability Table		
Information Technology Capability	**Existing Enterprise Capability to be Leveraged**	**New Enterprise Capability Needed**
Public or Internal Portal/Website	☒	☐
Public or Internal Mobile Application	☐	☐
Enterprise Service Bus	☒	☐
Identity and Access Management	☒	☐
Enterprise Content Management (including document scanning and eForms capabilities)	☐	☐
Business Intelligence and Data Warehousing	☒	☐
Master Data Management	☐	☐
Big Data Analytics	☐	☐

2.11.5 Project Phases

Stage 3 Solution Development	CDT Project Approval Lifecycle Stage 3 Solution Development

Description	Phase Deliverable
Completion of the Stage 3 solution development requirements by Caltrans assisted by a contractor.	1. Procurement Profile 2. Detailed Solution Requirements 3. Statement of Work 4. Solicitation Package 5. State Staffing Allocation

Stage 4 Product Readiness and Approval	CDT Project Appoval Lifecycle Stage 4 Product Readiness and Approval

Description	Phase Deliverable
Completion of Stage 4 of the Project Approval Lifecycle	1. Solicitation Release 2. Selection of Vendor 3. Contract Management Readiness 4. Baseline Project (Management) 5. Project Readiness 6. Risk Registration 7. DOF and/or Legislative Approval

CATMS System Integration	Design, Development, Testing, Implementation, and Training for the new CATMS solution

Description	Phase Deliverable
The system integrator will perform the following actions: 1. Requirements validation and traceability 2. Creation of the application, architecture, and security design 3. Development of interface control documents and specifications 4. Environment creation and testing to support development, testing, and training 5. Configuration, development, and testing of application software to meet the business needs and project objectives 6. Development of data migration methods that include data cleansing, validation, migration, and conversion 7. Creation and execution of a training plan and an organizational change management plan 8. Release 1 and Release 2 planning, development, and implementation. 9. Adherence and alignment with Caltrans change control processes and tools 10. Installation of configuration and customizations to support all functional areas of CATMS 11. Project closeout, final training results, lessons learned, and documentation	The system integrator will create the following deliverables during this phase*: 1.Project Management deliverables such as plans, schedule, and status reports 2.Requirements deliverables such as fit/gap analysis and a requirements traceability matrix 3.Design deliverables such as data conversion plan, system architecture, application design, interface specifications, security design, and data models documentation 4.Development deliverables such as data conversion reports, implementation plan, application executables, product demonstrations, and unit testing results 5.Testing deliverables such as test plans, test scenarios, test cases, and test results 6.Training deliverables such as training plans, training materials and guides, end user manual, and system administrator manual 7.Maintenance and Operations deliverables such as system management plan, installation processes and guides, and the maintenance and operations plan

	*The phase deliverables are described in general terms; more specific deliverables will be stated in the statement of work delivered with Stage 3.

Select + to add project phases.

2.11.6 High Level Proposed Project Schedule

Proposed Project Planning Start Date:	7/28/2020	**Proposed Project Planning End Date:**	2/14/2022
Proposed Project Start Date:	2/14/2023	**Proposed Project End Date:**	4/12/2024

Activity Name	Start Date	End Date
Stage 3 Solution Development	7/28/2020	3/2/2022
Stage 4 Project Readiness and Approval	9/9/2022	2/10/2023
Solicitation Release	5/5/2022	5/5/2022
Solicitation Award	2/14/2023	2/14/2023
Requirements	2/15/2023	4/11/2023
Design	4/12/2023	7/6/2023
Development	6/8/2023	1/19/2024
Data Migration	7/7/2023	11/24/2023
Testing	12/25/2023	2/16/2024
Deployment - Release 1	2/16/2024	2/16/2024
Deployment - Release 2	4/12/2024	4/12/2024
Training	1/22/2024	4/12/2024
Go Live	4/12/2024	4/12/2024

2.11.7 Cost Summary

Total Proposed Planning Cost:	$8,972,651.00
Total Proposed Project Cost:	$10,999,725.00
Total Proposed Future Operations IT Staff & OE&E Costs (Continuing):	$7,328,712.00
Total Proposed Annual Future Operations IT Costs (M&O):	$4,455,765.00

2.12 Staffing Plan

2.12.1 Administrative

Caltrans is committing senior-level staff with extensive administrative experience (budgets, procurement, personnel, and contract and project management). Caltrans will also leverage CDT STP staff for procurement and CDT staff for independent project management oversight. The administrative staffing structure (contract and project management) is identified through all phases of the project with the staffing role and job classification level shown in Attachment 5 – Staffing and Procurement Planning.

2.12.2 Business Program

Caltrans is dedicating staff to this project possessing extensive business process knowledge in the areas directly affected by the California Advanced Transportation Management System (Division of Traffic Operations and Information Technology). The project is guided by a seasoned Contract Manager who has years of direct experience managing, supporting and operating Advanced Transportation Management Systems and contracts. Subject matter experts from the 12 Districts will be available for Requirements, Design, Testing, OCM, and Training phases of the project to assist with the successful implementation of a CATMS solution that meets the project objectives and business needs.

Caltrans also evaluated the future operational needs to support CATMS and doesn't anticipate a change in staffing from current operations. As an input to our staffing plan an evaluation of staff allocations across the functional areas (i.e. Central Systems, TMS Field Support, TMC Operations, and Ramp Metering) was conducted. Next a review of efficiency improvement was conducted to detemermine the effects of migration from 12 legacy systems to a single CATMS solution. Although CATMS will replace 12 legacy systems state-wide, most Districts are only using two legacy systems and the current business processes for the functional areas will not change since migrating to CATMS will only alter data entry practices. As a result its expected that the same number of staff for current operations will be needed for future operations.

The business program staffing structure (Requirements, Design, Testing, OCM, Training, and future operations) is identified through all phases of the project with the staffing role and job classification level shown in Attachment 5 – Staffing and Procurement Planning.

2.12.3 Information Technology (IT)

The CATMS project will rely on infrastructure throughout the State that requires standard IT operations and support efforts. Aligned with the recommended solution, Caltrans staff have extensive experience in supporting state-wide infrastructure, network, and hardware, but will elicit COTS application support from the system integrator.

Similar to the Business Program staff, Caltrans evaluated the future operational needs to support the infrastructure for CATMS and estimates an increase of five IT staff from current operations. This staffing need will be supplemented by consulting staff for the duration fo the project. Details into the IT support for CATMS inclusive of staffing role and job classification level is documented in Attachment 5 – Staffing and Procurement Planning.

In addition, Caltrans is creating a formalized interdepartamental agreement between the Business Program (District staff from Traffic Operations) and Caltrans IT. As the project progresses through future stages of the project the Financial Analysis Worksheets and Attachment 5 – Staffing and Procurement Planning may be updated with staff allocation changes pertaining to the IT and Business Program interdepartamental agreement.

2.12.4 Testing

Caltrans understands that testing is critical to ensure the State gets a product that meets the business objectives and that the transition to enterprise operations is as smooth as possible. Caltrans is dedicating business, IT staff, and system integrator to support testing. To aid in the testing process and confirm the business objectives are met, the system integrator will lead testing activities and will be required to use Caltrans enterprise tooling for requirements traceability and test management. The Caltrans IT staff have extensive experience with the Caltrans enterprise tooling for test management oversight and test execution through the various phases of testing (e.g. system, integration, security, performance, and regression testing). User acceptance testing will be executed with a mixture of business and IT staff. Using this approach Caltrans will be able to leverage the most applicable skills from each role. IT staff will test non-functional requirements while the Business Program and end users focus on functional requirements. The testing personnel structure is identified through all phases of the project with the staffing role and job classification level shown in Attachment 5 – Staffing and Procurement Planning.

2.12.5 Data Conversion/Migration

Caltrans will utilize the system integrator to conduct Data Conversion and Migration activities to support the transition to CATMS. Caltrans expects a minimal set of field element device configuration data to require migration from the legacy system, but will refine the data conversion/migration requirements in Stage 3. Staffing needs for conversion and migration will be addressed by the system integrator and estimates are provided in Attachment 5 – Staffing and Procurement Planning.

2.12.6 Training and Organizational Change Management

Training and Organizational Change Management (OCM) for system and business process changes are critical to CATMS' success. The recommended solution will be COTS, but based on the demonstrations provided as part of market research only a slight business change is expected to align with a system integrators out of the box offering. OCM and Training will be led by the system integrator and is expected to start early in the project lifecycle. Its understood that the CATMS Project Sponsor and Functional leads from the 12 Districts will need to champion OCM and Training efforts with direct support from the system integrator so their involvement wil be critical. The staffing structure for training and OCM is identified through all phases of the project with the staffing role and job classification level shown in Attachment 5 – Staffing and Procurement Planning.

2.12.7 Resource Capacity/Skills/Knowledge for Stage 3 Solution Development

CATMS staff have extensive experience with Caltrans' contract procurement, management, the business programs and processes. The CATMS business program team has already conducted internet research, interviewed other state agencies that have similar transportation management needs, and hosted vendor demonstrations to collect information on industry offerings and viable alternatives. This information, as captured in our Market Research, was used to define alternatives, identify areas that need requirement improvements, and clarify procurement considerations. Caltrans IT has the technical knowledge and has contributed to the alternatives and requirements while facilitating a formal decision-making framework for architectural approval. At Caltrans, IT leverages an internal Enterprise Architecture Committee (EAC) to evalaute alternatives and requirements. Once the EAC is satisfied with the content it then recommends review at Information Technology Executive Council (ITEC) for formal technical approval and confirmation of strategic IT direction. Throughout this formal process our teams work closely with CDT staff to ensure these activities have been comprehensive and in alignment with CDT Project Management Framework (PMF) best practices. When requirements have been vetted and approved, Caltrans will then work with the CDT State Technology Procurement (STP) division on this project. CDT sets the standard for precision, experience, skill, and accuracy for IT procurement in state government. The overall staffingneeds for Stage 3 is shown in the Attachment 5 – Staffing and Procurement Planning and are identified in the planning phase of the project.

2.12.8 Project Management

2.12.8.1 Project Management Risk Assessment

Project Management Risk Score:	0.4
Attachment: Attach file to email submission.	Attachment 6 - SIMM 45 Appendix A PM Risk Assessment.pdf

2.12.8.2 Project Management Planning

Are the following project management plans or project artifacts complete, approved by the designated Agency/state entity authority, and available for Department of Technology review?		
Project Charter	Yes	Attachment 7 - Project Management Plans.pdf
Scope Management Plan	No	…
Risk Management Plan	Yes	Attachment 7 - Project Management Plans.pdf
Issue and Action Item Management Plan	Yes	Attachment 7 - Project Management Plans.pdf
Communication Management Plan	Yes	Attachment 7 - Project Management Plans.pdf
Schedule Management Plan	No	…
Human Resource Management Plan	Yes	Attachment 7 - Project Management Plans.pdf
Staff Management Plan	Yes	Attachment 7 - Project Management Plans.pdf
Stakeholder Management Plan	Yes	Attachment 7 - Project Management Plans.pdf
Governance Plan	Yes	Attachment 7 - Project Management Plans.pdf

2.12.9 Organization Charts

Below is the organization chart for the CATMS project and attached are Caltrans organization charts for reference.

Attachment: Attachment 8 - Caltrans Organization Chart.pdf

2.13 Data Conversion/Migration

Identify the status of each of the following data conversion/migration activities:

Data Conversion/Migration Planning	Completed	Data Quality Assessment	Not Started
Data Conversion/Migration Requirements	In Progress	Data Quality Business Rules	Not Started
Current Environment Analysis	Completed	Data Dictionaries	Completed
Data Profiling	Not Started	Data Cleansing and Correction	Not Started

Caltrans has completed planning, current enviornment analysis, and has documented data dictionaries of the various legacy systems being replaced by CATMS, where possible. Attachment 9 - Data Conversion Documentation captures data dictionaries and, where it was possible to export from the legacy system's database, entity relationship diagrams. The system integrator will be responsible for data profiling, quality assessment, business rules for data mapping, and cleaning/correction during migration. Requirements for data conversion and migration will be included in Stage 3 detailed requirements and the system integrator will align with the Caltrans Data Governance Plan.

Attachment: Attachment 9 - Data Conversion Documentation.pdf

2.14 Financial Analysis Worksheets

Attachment: Attachment 10 - CATMS Financial Analysis Worksheets.pdf

Preliminary Assessment – Department of Technology Use Only	
Original "New Submission" Date	6/25/2021
Form Received Date	10/18/2021
Form Accepted Date	10/18/2021
Form Status	Completed
Form Status Date	12/23/2021

Main Form – Department of Technology Use Only	
Original "New Submission" Date	6/25/2021
Form Received Date	10/18/2021
Form Accepted Date	10/18/2021
Form Status	Completed
Form Status Date	12/23/2021
Form Disposition	Approved
Form Disposition Date	12/23/2021