Grant Submittal 693JJ317NF0001

Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Initiative

Utah Connected

Volume 1: Technical Application

June 12, 2017

Submitted to **U.S. Department of Transportation**
by **Utah Department of Transportation**

Table of Contents

Cover Page

Project Name	Connected Utah
Eligible Entity Applying to Receive Federal Funding	Utah Department of Transportation
Total Project Cost (from all sources)	$15,568,343
ATCMTD Request	$6,246,683
Are matching funds restricted to a specific project component? If so, which one?	State funds used as matching funds are not restricted to a specific project component. Private funds, provided by South Central Communications, are restricted to Project 1.1: Fill Fiber Gaps along Southern I-15
State(s) in which the project is located	Utah
Is the project currently programmed in the: • Transportation Improvement Program (TIP) • Statewide Transportation Improvement Program (STIP) • MPO Long Range Transportation Plan • State Long Range Transportation Plan	Only one element of UDOT's matching funds is currently programmed in the STIP: "I-15 MP 22 to MP 28, Add NB Climbing Lane", which includes some fiber optic construction valued at approximately $425,000
Technologies Proposed to Be Deployed (briefly list)	Fiber optic communications, Variable Speed Limit (VSL) System, Road Weather Information System (RWIS), Variable Message Signs (VMS), Smart Corridor, Dedicated Short Range Communications (DSRC) Connected Vehicle Systems, Signal Priority, Traveler Information, Automated Vehicle Occupancy Detection

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

DEPARTMENT OF TRANSPORTATION

CARLOS M. BRACERAS, P.E.
Executive Director

SHANE M. MARSHALL, P.E.
Deputy Director

June 12, 2017

U.S. Department of Transportation
Federal Highway Administration
Office of Operations
1200 New Jersey Avenue, SE
Washington, DC 20590

Attn: David Harris

Dear Mr. Harris:

SUBJECT: Proposal in response to Notice of Funding Opportunity Number 693JJ317NF0001

The Utah Department of Transportation (UDOT) offers the attached proposal, Utah Connected, in response to Solicitation 693JJ317NF0001, "Advanced Transportation and Congestion Management Technologies Deployment Initiative." UDOT is dedicated to innovation and the deployment of new technologies to benefit the travelers in and through the state of Utah. We are equally dedicated to leveraging significant investment made in our Intelligent Transportation Systems (ITS) deployments, and we believe that the projects we propose will help us achieve our agency's vision to "Keep Utah Moving" by enhancing mobility, increasing safety (towards UDOT's goal of Zero Crashes, Injuries and Fatalities), and optimizing the value of our infrastructure investment.

Utah is currently ranked as the fastest growing state in the nation[1], with population increasing rapidly in both the urban and rural areas. The population growth in our state will be accompanied by challenges in maintaining mobility, safety, and access to real-time information, which obligates us to keep abreast of advances in technology and deployment, best practices and lessons learned nationwide.

For over twenty years UDOT has been known as an innovator in transportation technology, with Automated Traffic Signal Performance Measurements (ATSPM), public-private fiber optics deployments, diverging diamond and continuous flow interchanges, accelerated bridge construction, design-build contracting, and a willing contributor to the transportation community.

We believe that Utah offers unique characteristics, extensive ITS infrastructure, and connected vehicle experience that can be leveraged to support a successful expansion of our

[1] *Utah Economic Outlook,* Governor's Office of Management and Budget

advanced transportation and congestion management efforts. These include a statewide fiber network (approximately 2,200 miles of UDOT-owned or shared fiber) to facilitate backhaul; a centrally controlled traffic signal system that connects 89 percent of Utah's 1990 statewide traffic signals (including state-owned and municipal-owned signals); and an extensive, integrated, award-winning transit system in the Salt Lake City metropolitan area. In addition, we are in the final stages of deploying dedicated short-range communications (DSRC) equipment and implementing a transit priority connected vehicle application in the Salt Lake City metro area. State-wide probe data from a third party, in the final stages of procurement as of this submission, will contribute to the information toolbox supporting all proposed projects.

We are proposing and are poised to successfully deliver several projects under three general categories: Rural Foundational Technology, Connected Vehicles Realized, and Data and Information Sharing. We feel that the distribution of projects within those categories will serve to address needs of both rural and urban populations, using a variety of methods to achieve success.

Sincerely,

Shane M. Marshall, P.E.
Deputy Director

SMM/BL/dej

INTRODUCTION

✓ Utah Connected moves closer to the first truly Smart State

The Utah Department of Transportation (UDOT), with its foundational statewide network of fiber and legacy advanced transportation infrastructure, an urban connected vehicle deployment currently in final testing, and robust set of traveler information systems and services, proposes to expand the principles of Smart City deployment to become the first true Smart State in the country. ***Utah Connected*** builds upon the established technical, institutional, and private sector strategic relationships established across the State and throughout the region to address traffic congestion, mobility, and public safety concerns.

The significant investment in fiber connectivity statewide made over the past several years puts Utah in a unique position to take the ideas behind Smart Cities to the next level and deploy the first **Smart State** in the nation. This program will continue to provide connectivity benefits to citizens around the entire state—urban and rural. ***Utah Connected*** leverages significant previous investment enhancing the benefits Utah already enjoys, including the State's extensive fiber optic network, statewide signal interconnectivity, existing performance management, a soon-to-be operational Connected Vehicle corridor — also a first in the nation — and road weather and active traffic management field equipment. State-wide probe data from a third party, in the final stages of procurement as of this submission, will be used to support the deployment of the ***Utah Connected*** program. Our support from the State Legislature is considerable and consistent, and Utah is home to the "Silicon Slopes" program (https://siliconslopes.com/), welcoming software companies throughout the nation to spur innovation and incubate new ideas.

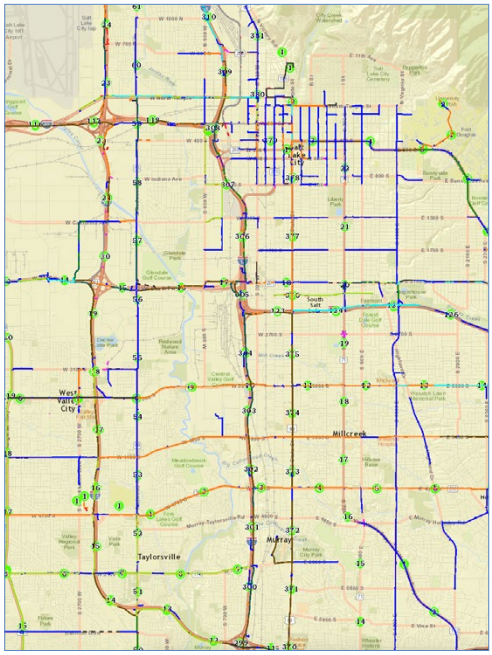


Figure 1 Fiber Map / Salt Lake City Area

UDOT brings strong leadership and political support, and a significant existing foundation of ITS deployment

Beyond foundational technology, we bring a strong and cooperative partnership between all levels of government and modes of travel. UDOT leads the nation in the collaboration of a common traffic signal management system across the state with over 89% of state, county, and city signals interconnected including Automated Traffic Signal Performance Metrics (ATSPM) capabilities. This unique arrangement makes collaboration easy. UDOT worked hand in glove with the Utah Transit Authority (UTA) in the development of a Concept of Operations for an Integrated Corridor Management (ICM) system. That ConOps includes managed lanes, heavy rail, light rail, and bus modes of travel, along with the critical traveler information channels to disseminate information to those who need it. Our Connected Vehicles program is implementing the first Dedicated Short Range Communication (DSRC)

corridor for operational use, providing UTA with smart transit signal priority (TSP) capabilities. No place else brings this combination of infrastructure, relationships, functionality, and innovative approaches. All of these together allows Utah to lead the nation in advanced transportation technologies.

Lead by UDOT, this ***Utah Connected*** grant application pulls together the missing pieces, identifying key gaps in the current deployments to expand the existing program to create the foundational technology program necessary to provide a state that is truly connected; a complete ***Utah Connected.*** The following proposed projects will fill these gaps. Our proposed projects have been organized into broad categories to highlight the holistic nature of our program linking all citizens, urban and rural, to the benefits of these technology implementations:

Package 1: Rural Foundational Technology

- Project 1.1: Fill Fiber Gaps along Southern 1-15
- Project 1.2: Install I-15 Variable Speed Limit System
- Project 1.3: Install Additional RWIS and Cameras in Rural I-15 Locations
- Project 1.4: Install Variable Message Signs along I-15 in Southern Utah
- Project 1.5: Implement Rural US 6 Smart Corridor Improvements

> *"The UDOT fiber optic network is one of the most robust and well connected networks in the entire country."*
>
> *LYNNE YOCOM, UDOT FIBER MANAGER*

Package 2: Connected Vehicles Realized

- Project 2.1 Enhance and Expand Operational Connected Vehicle Arterial Corridors
- Project 2.2 Implement Connected Vehicle Applications for public safety

Package 3: Data and Information Sharing

- Project 3.1: Modernize Advanced Traveler Information Dissemination
- Project 3.2: Express Lanes Violation Verification

UDOT recognizes the importance of collecting, evaluating, and sharing *measurable and quantifiable* benefits. Of all the projects considered for possible inclusion in this proposal, those that made the list did so because each will generate datasets that UDOT and the transportation community can track, evaluate, and use to improve operations and follow-on strategic planning. In fact, UDOT's Signal Performance Measures project, which helped to revolutionize the industry and perception of data sharing, will be utilized to package datasets that can be easily shared with USDOT and transportation agencies throughout the country.

AGREEMENT ENTITY

UDOT brings an open approach to deploying applications that could be used by other agencies. UDOT currently shares signal data through its revolutionary Signal Performance Measures Project.

Utah Department of Transportation

The Utah Department of Transportation (UDOT) is the statewide transportation authority, responsible for all projects, programs, and funding programmed for highway transportation in the State.

UDOT is a national leader in identifying, deploying, and harnessing the benefits of Intelligent Transportation Systems (ITS). We are leaders in performance measurement, traffic signal operations and interconnectivity, and we are on the cutting edge in our uptake of connected vehicle and smart city technologies. UDOT is focused on the emphasis areas of integrated transportation, collaboration, education, transparency, and quality. This proposal aims to build upon this foundation, and take us to the next level as a Smart State.

PARTNER ORGANIZATIONS

Utah Transit Authority

UDOT and the Utah Transit Authority (UTA) have a long and successful working relationship addressing the needs of travelers within and through the state of Utah. Partnership, collaboration and innovation are part of the working culture in Utah. UDOT maintains a close working relationship with the UTA, and is currently collaborating on a connected vehicle transit priority project and a second, large bus rapid transit project. UDOT cooperates on a daily basis with counties and cities all over the state to effectively manage traffic. These relationships facilitate the efficient collection and sharing of data.

Communications Partners

UDOT maintains relationships with such telecommunications partners as Centracom, South Central Communications, Emery Telecommunications, Strata Networks, Beehive Telecommunications, First Digital, Zayo, and Utopia. UDOT has staff dedicated to the maintenance of active relationships with these telecom companies. Through these mutually beneficial relationships, UDOT allows the telecoms to install fiber in UDOT's right-of-way, which in turn provides additional fiber infrastructure for UDOT to expand our Advanced Transportation Management Systems (ATMS/ITS) network. We have doubled our fiber reach through these public-private partnerships. Our partnership with rural communications companies are critical in providing access and connectivity critical to the economic vitality of these rural areas. Competitive pricing is achieved through competition.

Equipment Vendors

Through its many ITS, connected vehicle and traveler information programs, UDOT has existing contracts with several equipment vendors. We are familiar with the products and services provided by these firms. Our proposed program may include the procurement of services and equipment from the following:

- Wavetronix
- Daktronics
- Econolite
- Intelight
- Wanco
- Savari
- Lear
- Statewide traffic data vendor, currently in procurement

APPROACH TO PROGRAM MANAGEMENT

UDOT understands the responsibility of shepherding complex project delivery, and is well-equipped to effectively manage the proposed program through all project stages including planning and procurement, design, development, deployment and operation. UDOT has been the steward of federal funding for many projects in the past and has the controls and processes established to properly manage the funds provided to achieve the objectives set out in this proposal. Our Program Management approach will include documented processes to manage planning and reporting requirements designed to keep U.S. DOT updated on all aspects of the project. The projects undertaken will be guided by Blaine Leonard, P.E., F.ASCE. Mr. Leonard will provide oversight of all efforts and serve as the direct point of contact with US DOT.

Scope and Schedule

Scope and Schedule Management – Rigorous scope and schedule management will provide the tools to manage scope creep, so that the budget and schedule can be properly adhered to while accommodating necessary changes. The draft Scope and Schedule Management Plan will be delivered within 30 days of contract award. This plan will document a shared understanding of the entire project scope, and provide details regarding roles and responsibilities in terms of schedule management, frequency of updates, and distribution of the updated schedule and Work Breakdown Structure (WBS). Included in the Scope and Schedule Management Plan will be a fully detailed Project Schedule. Using an estimated start date of January 3, 2018 our proposed Project Schedule includes a staggered schedule of project deployment, with all projects deployed and in the O&M stage by the end of the third fiscal year after Notice To Proceed, October 1, 2020. The WBS will guide the work of each Project Manager, assigned to discrete projects.

Cost Management – The project will be managed using the Earned Value Method (EVM); a process that will allow the project team to chart the progress of planned budget versus actual expenditures. The EVM methodology provides a means to forecast future performance based upon past performance (PMBOK Fifth Edition.) A sample EVM chart is provided in Figure 2. Day-to-day cost management and tracking will be managed by the program manager Blaine Leonard.

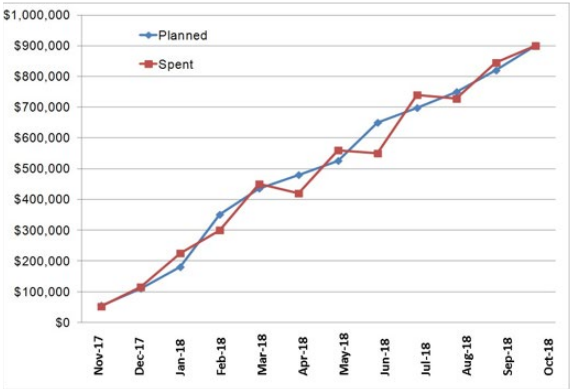


Figure 2 Sample EVM Chart

Meetings and Reporting

Kickoff Meeting – Within four weeks after award, the UDOT Project Manager will work with U.S.DOT to arrange a Kick-off Meeting, to take place at FHWA headquarters in Washington D.C., at UDOT offices in Salt Lake City, or another location to be determined.

Monthly Progress Reports – The UDOT Program Manager will submit monthly reports on the progress of the program overall to include, at a minimum; overall project progress, current status of each deliverable, status of planned events for the month, identification and explanation of deviations from schedule, risk register and its status, and planned activities for the coming reporting period. We will also describe any

risks associated with our partners' work or relationship to the project. The monthly status reports will include a general project update and updates of each of our proposed applications.

Annual Report to the Secretary – In an Annual Report to the U.S. Secretary of Transportation, Mr. Leonard will provide an update regarding the activities, achievements, milestones met and issues encountered during the previous year. Data to illustrate the relationship between deployment and operational costs compared to quantifiable benefits and savings will be presented in the Annual Report. The baseline supporting development of the Annual Report will be derived from the original expectations set out in the Deployment Plan.

GEOGRAPHIC AREA SERVED

The proposed program serves a range of geographic locations as illustrated in Figure 3. The individual projects include efforts in the Salt Lake City metropolitan region as well as rural areas along southern I-15 and US 6, southeast of Salt Lake City.

Salt Lake City Region

The Salt Lake City region is world-renowned for its picturesque landscape. Located in a high desert valley, natural growth boundaries are found in the Wasatch Mountain Range to the east, the Oquirrh Mountain Range to the west, the Great Salt Lake to the northwest, and Utah Lake to the southwest. Because of this unique geographic setting, the Salt Lake urban area has developed into a long and linear metropolis, locally known as the Wasatch Front, rather than a traditional urban sprawl pattern. Within this linear metropolitan area, Interstate 15 (I-15) is the principal north/south freeway with I-215 providing a bypass route around downtown Salt Lake City to the west. Exceeding volumes of 230,000 vehicles per day in some sections, I-15 is the transportation spine for the entire region. Running parallel to I-15 are the primary UTA light rail (TRAX) and commuter rail (FrontRunner) lines, which combined carry over 80,000 riders per day. These three transportation systems are already part of a regional integrated corridor management program. The elements of this ICM were first developed ahead of the 2002 Winter Olympics, and are particularly sophisticated for a city this size.

In addition, situated between I-15 and I-215 is Redwood Road, which serves as a major north south arterial. Redwood Road is the nexus of UDOT's soon-to-be operational connected vehicle corridor using 5.9 GHz DSRC roadside units to enable TSP for UTA buses equipped with DSRC on-board units (OBUs).

US 6 Corridor

The US 6 highway provides a scenic and mountainous connection from I-15 south of Salt Lake City to I-70. It is a well-traveled road favored by truckers because it is one of the shortest routes between Denver and Salt Lake City. The percentage of trucks can approach 40 and Average Annual Daily Traffic (AADT) volumes range from 3,500 vehicles near I-70 to nearly 10,000 closer to I-15. Further, US 6 experienced six fatalities in 2016. The road is also popular for tourists traveling from the Utah and Salt Lake valleys to the national parks and other recreational meccas of southeastern Utah. Finally, the highway is also subject to severe winter weather.

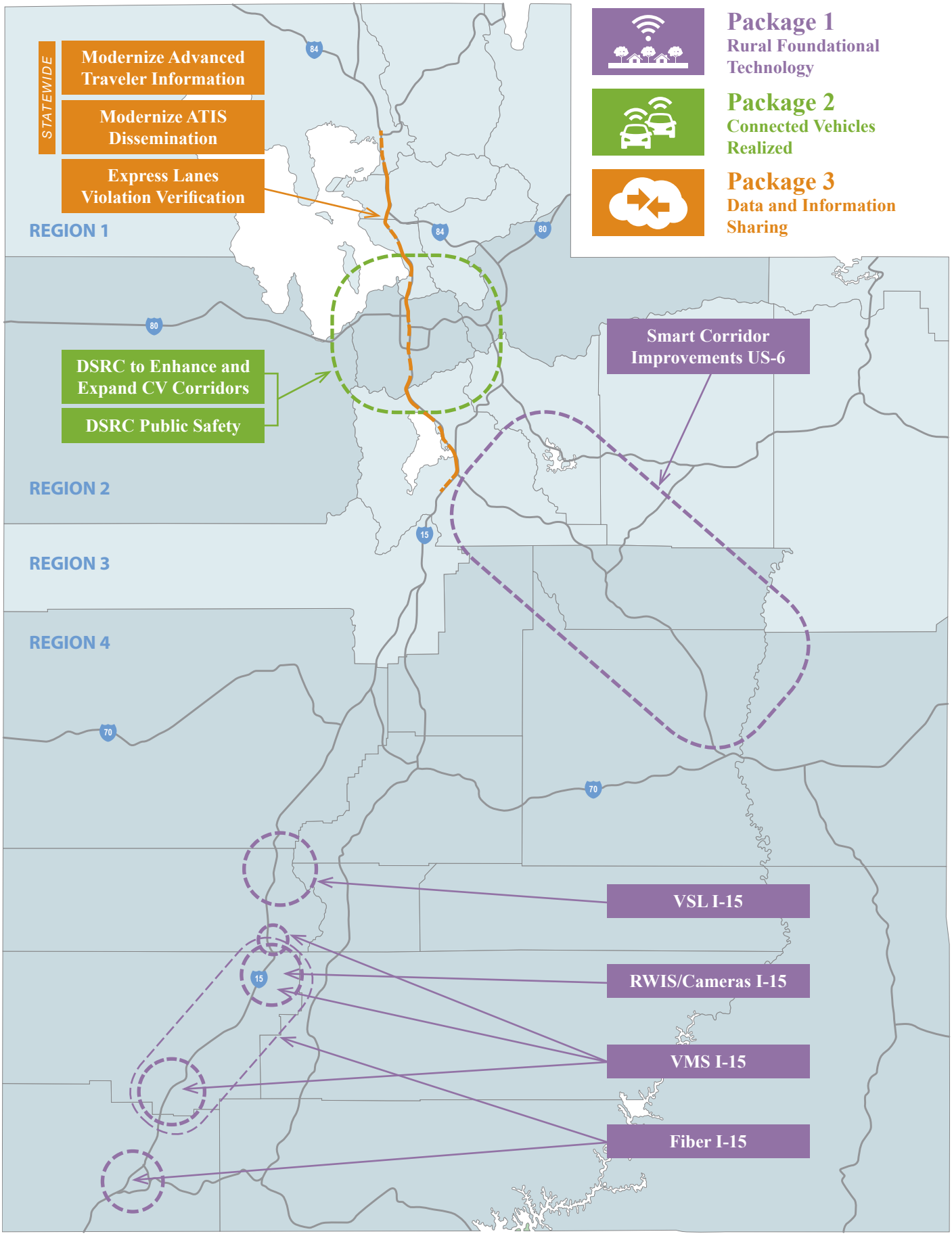


Figure 3 Program Location Map

Southern I-15

Interstate 1-15 runs from Salt Lake City through Las Vegas and on to Los Angeles running for 1,434 miles. The I-15 Mobility Alliance recognizes the corridor for its movement of goods and people connecting trade gateways, tourist destinations and population centers. The section of I-15 from the Arizona state line to the urbanized Wasatch Front is over 250 miles long and almost entirely rural. The AADT is generally over 20,000 vehicles with trucks around 45 percent. Southern Utah is also home to five significant national parks, and numerous state parks and other recreational sites. Many visitors use I-15 to access these scenic areas. As with US 6, severe weather and steep hills can be an issue along I-15.

Overall, Utah is a major corridor for cross-country travel, as well as a destination.

ISSUES AND CHALLENGES ADDRESSED BY THE PROGRAM

With its fast paced growth, Utah is facing the myriad transportation issues of congestion, reduced mobility, and capacity commonly found in urban America. The topography of the Salt Lake Valley contributes to significant problems with air quality. At the same time, Utah includes world-famous national parks, as well as mountains and deserts in remote locations which experience different sets of transportation challenges. Utah is a major trucking hub, with commercial vehicles traveling to and from the ports of Los Angeles, Long Beach and San Francisco. Hosting truck traffic and tending to the needs of the trucking industry is critical to the economy not just of Utah, but of the entire U.S. Finally, Utah is a cold weather state that regularly experiences snowstorms during the winter months, creating hazardous road conditions in the urban and rural areas, as well as the mountain passes. This proposed program will address the following issues and challenges based on the specific aspects of each program element:

1. **Safety:** Utah is committed to the national Zero Fatalities initiative. In 2016, statewide there were 280 roadway fatalities including 61% in urban areas and 39% in rural parts of the state. ***Utah Connected*** includes the implementation of a red light warning CV application on the UDOT's DSRC operational arterial corridor. The expansion of the high speed communications network will allow for the deployment of a VSL system, as well as the installation of new Variable Message Signs (VMS) on sections of rural I-15 in southern Utah and rural portions of US 6.

2. **Reliability:** As part of the UDOT's strategic direction to optimize mobility, several proposed projects offer the opportunity to improve the reliability of a vehicle reaching its destination on time at least 95% of the time. Better signal control, TSP, and the improvement of DSRC corridors, are part of addressing this challenge.

3. **Delay:** Delay is defined as the additional travel time experienced by a traveler due to traffic conditions that impede travel. Elements of this program will improve signal operations, bus operations, and quality of roadway condition information disseminated to travelers.

4. **Weather:** Utah is a mountainous state and at a high elevation. Winter weather can be quite severe, and have significant impact on mobility and safety. As an agency initiative, UDOT is striving to remove snow and ice to an acceptable level across the state roadways at least 90% of the time. The DSRC corridors will equip snow plows with DSRC units to afford them signal priority to increase their efficiency. The expansion of communications, Road Weather Information System (RWIS), and related roadside equipment along rural I-15 and US 6 will improve monitoring of weather conditions and provide timely weather condition information to travelers.

5. **Communications**: UDOT has deployed over 2,200 miles of fiber optic cable, either through direct installation or partnership trades, to provide a high speed network that interconnects UDOT, county and city traffic signals and centers as well as roadside ITS and tolling equipment. This physical connection binds together jurisdictions at every level to share and better manage the transportation system. Additionally, UDOT partners with a dozen private telecommunication providers to share the cost of the communication infrastructure. These partnerships serve to reduce costs to UDOT as well as provide new communication paths that can be offered to the public. Those new communications paths will also provide better access to rural and underserved communities, serving as a foundational element of economic opportunity. Several of the projects proposed expand the fiber network.

6. **Collaboration:** UDOT has placed a premium on collaboration with local jurisdictions, transit agencies and planning organizations across the State. The prime example is the implementation of a single common traffic signal system throughout the State that interconnects over 89% of all traffic signals. This program will continue the collaborative efforts by adding more signals, improving TSP and data sharing.

PROPOSED PROGRAM OF TRANSPORTATION SYSTEMS AND SERVICES

Utah Connected continues the effort to build foundational technology, expands upon CV deployments, and taps into expanded data sources provided by this program and operational efforts. The program is divided into three packages:

- **Package 1: Rural Foundational Technology:** Fills critical communication gaps along I-15, adds VMS and a VSL system along the corridor, and expands ITS and RWIS capabilities along rural US-6.

- **Package 2: Connected Vehicles Realized:** Builds on the soon-to-be operational CV arterial corridor by expanding to two new arterials, and installing new equipment on snowplows, private trucks and transit vehicles.

- **Package 3: Data and Information Sharing:** Builds upon the extensive intersection, signal, freeway, image, and weather data generated by UDOT and its partners to modernize UDOT's Advanced Traveler Information System (ATIS) and improve Express Lanes Violation Verification.

Package 1: Rural Foundational Technology

Package 1 consists of several projects designed to address common issues experienced by Utah's rural communities in the areas of safety, mobility and economic vitality. UDOT has had tremendous success partnering with telecommunications firms throughout the state to bring high speed fiber into rural areas that previously lacked the access and convenience taken for granted in other more urban areas. UDOT allows the companies to install fiber in the right-of-way, and UDOT is then able to use that fiber, and other fiber previously installed by those companies, to expand the reach of beneficial services to new areas. Lynne Yocom of UDOT will serve as the Key Staff in charge of management and execution of Package 1. Ms. Yocom's bio is provided in the Key Staff section later in this proposal.

Project 1.1 Fill Fiber Gaps Along Southern I-15

Expansion of the ITS Digital Backbone on I-15 in southern Utah is a near term goal of UDOT. In fact, UDOT's ultimate goal is to install fiber from end-to-end on all 400 miles of I-15, critical to in-state travelers as well as the commercial trucking industry. This package will complete major gaps in the communication network along I-15, including a rural but critically important section of I-15 that links the growing communities around St George and Cedar City, Utah.

The engagement of private sector communication providers who are willing to share the costs and construction of these new links is a key to advancing the fiber backbone. To execute Project 1.1, UDOT will be installing fiber on I-15 between Mileposts (MP) 16 and 27 (11 miles) and Mileposts 43-52 (9 miles). South Central Communications will be installing fiber, at their cost, between mileposts 60 and 98, bringing to the project an additional 38 miles of fiber on this rural portion of I-15.

Project 1.2 Install Variable Speed Limit System Along Southern I-15

VSL corridors are sections of roadway with digital speed limit signs subject to change based on roadway conditions during weather events, construction, incidents and other situations that may affect mobility or safety. VSL has been demonstrated to be effective in reducing accidents on mountainous roadways during severe winter weather. In early 2014, UDOT installed its first VSL installation along I-80. This section of highway links Salt Lake City with Park City to the east crossing over the Wasatch Range through Parley's Canyon. As part of this package, VSL will be installed along a 23-mile section of I-15 north of Beaver, known as Pine Creek, where the terrain is steep and weather changes drastically.

Project 1.3 Install Additional RWIS and Cameras in Rural I-15 Locations

In addition to the VMS and VSL, cameras, speed detection, and RWIS stations in key locations on I-15 will be added and connected to the new fiber network. These RWIS locations will augment other RWIS stations along the I-15 corridor and address critical geographic-specific problems that cause crashes and delays in inclement weather.

Project 1.4 Install Variable Message Signs along I-15 in Southern Utah

The construction of these missing fiber communication gaps will enable the installation of three VMS at previously identified key sites along I-15. Along these long, rural freeway corridors, with significant freight and visitor traffic, VMS are useful in managing traffic and warning motorists of inclement weather and other hazards. The proposed VMS sites include: SB at MP 44 (Black Ridge), SB at MP 97 (SR-20), and NB at MP 106 (South of Beaver). The Beaver VMS will support the deployment of the VSL project.

Project 1.5 Implement Rural US 6 Smart Corridor Improvements

Another key rural corridor in Utah is the US-6 corridor. This highway provides a scenic and mountainous connection from I-15 south of Salt Lake City to I-70. It is a well-traveled road and is critical to commercial vehicle traffic because it is one of the shortest routes between Denver and Salt Lake City. It is also a preferred route to the scenic, recreational areas of southeastern Utah. The recent completion of a fiber communication network along this corridor through a public-private partnership provides the basis for moving forward with the implementation of smart highway technology along rural US 6. The transformation will include installing cameras, sensors, small VMS, and additional RWIS stations to help safely manage traffic along this busy corridor.

Package 2: Connected Vehicles Realized

Having participated in the Connected Vehicle Pooled Fund Study and the American Association of State Highway Transportation Officials (AASHTO) Connected Vehicle Task Committee for over a decade, the UDOT decided in late 2015 to begin planning for a deployment of connected vehicle applications. Now, UDOT is in the final testing stage for a connected vehicle deployment in Salt Lake County. This corridor follows Redwood Road, a state-owned, north-south arterial in the Salt Lake metro area, through 35 signalized intersections. Redwood Road traverses industrial areas, commercial districts, residential neighborhoods, and educational institutions. The system deployed for this corridor grants conditional signal priority to transit vehicles in order to maintain their schedule reliability. The application, called Multi-Modal Intelligent Traffic Signal System (MMITSS), was deployed and is managed jointly by UDOT and the Utah Transit Authority (UTA). Using MMITSS, DSRC OBUs allow buses owned by UTA to request signal priority when they are behind schedule. When operational, this may be the first day-to-day, operational DSRC deployment in the United States. Chuck Felice of UDOT will serve as the Key Staff in charge of management and execution of Package 2. Mr. Felice's bio is provided in the Key Staff section later in this proposal.

Project 2.1 Enhance and Expand Operational Connected Vehicle Arterial Corridors

Package 2 expands and enhances the connected vehicle corridor in urban Salt Lake County. Based on this working solution, the connected vehicle system will be expanded to two corridors: 5600 W and 8400 W. Deployment in the two corridors will be enabled through the expansion of the fiber communication network along both of these corridors. UDOT will install MMITSS with roadside DSRC hardware along portions of these two corridors, and put DSRC on UTA buses, UDOT snowplows, and selected private

trucking company vehicles to facilitate signal priority. The UTA buses will use priority when behind schedule to get back on schedule, as it does on Redwood Road. UDOT plows will have signal priority or pre-emption while plowing to keep them moving through intersections, yielding more efficient operations and safer roadways. Private commercial vehicles will get signal priority in certain areas of 5600 W and 8400 W to keep freight moving and reduce pollution. If successful, implementation could be expanded to other corridors later under different funding sources.

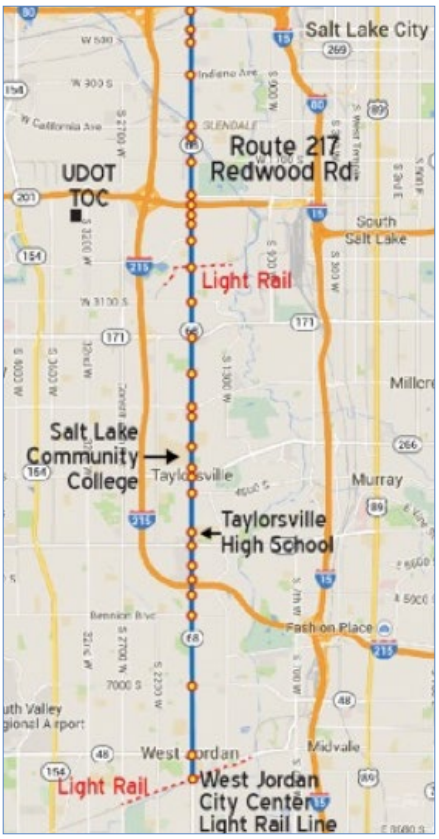


Figure 4 Redwood Road Corridor, Showing Locations of Signalized Intersections

Project 2.2 Implement Connected Vehicle Applications for Public Safety

Another feature of the MMITSS software is a module which enables pedestrians to more safely cross at busy, signalized intersections. The project will include the incorporation of this module. This application will be deployed near Salt Lake Community College, a busy urban campus on Redwood Road. This effort will include recruiting volunteers and providing them with the application.

On the safety side, this package will deploy a Red Light Violation Warning application along the Redwood Road corridor to help prevent red-light crashes. The software will be available on the Open Source website www.data.gov in 2018, after development progresses as part of the Columbus (Ohio) Smart City Initiative. UDOT vehicles and public volunteers will have DSRC devices installed on their vehicles to make this application functional.

These applications will dovetail with the ATIS projects proposed under Package 3, including notifications to drivers. An outreach effort to various stakeholders, including frequent freight users, will attempt to have DSRC equipment added to their vehicles to leverage these applications.

The end result will be the expansion of connected vehicle corridors and the deployment of multiple applications. These corridors will provide opportunities for additional application deployments as they become available.

Package 3: Data and Information Sharing

The wide range of roadside sensors and emerging vehicle-based information is generating a wealth of real time and historical data on intersections, signals, freeway, vehicles, weather, construction, event, and crashes. UDOT is also in the process of purchasing statewide traffic probe data, and should have this in place by early summer 2017.

UDOT was an early adopter of a 511 traveler information system in 2004. In the time since UDOT first deployed a 511 phone system, followed by a website, the agency has seen the technology supporting traveler information grow and change, and with it, the expansion of options for obtaining travel information. In the last several years, UDOT has continued to innovate, adding new and more effective channels for information dissemination as well as including Utah travelers as sources of information through ground-breaking programs in crowdsourced road conditions (Citizen Reporter) and other critical information tools. UDOT's mobile traffic app has been a great success, having been downloaded by almost one-quarter of the state's population. UDOT was one of the first members of Waze's Connected Citizens Program, which provides crowdsourced traffic data to UDOT. Lisa Miller of UDOT will serve as the Key Staff in charge of management and execution of Package 3. Ms. Miller's bio is provided in the Key Staff section later in this proposal.

Project 3.1: Modernize Advanced Traveler Information Dissemination

This package will improve the dissemination of UDOT's traveler and emergency information through several projects focused on the modernization of UDOT's current ATIS. Those include a remodeling of the UDOT Traffic Mobile App, to include a section dedicated to information for truckers. A retooling of the aging IVR system will provide a streamlined, floodgate message-based system that is estimated to cost a fraction of the current IVR. Utah is home to some of the best skiing and mountain recreation in North America, as well as several special events such as the Sundance Film Festival and World Cup Ski events. Touch screen panels installed at ski resorts and other high traffic locations will improve availability, reduce frustration, improve visibility of UDOT products, and provide an excellent opportunity for partnership with some of Utah's most popular recreational areas. Finally, the state's traveler information dissemination program will benefit from a range of long-planned improvements to the software used to process information at UDOT's Traffic Operations Center.

Project 3.2: Express Lanes Violation Verification

The last package element will add the automated collection of vehicle occupancy data along the I-15 tolled express lane to improve operational efficiency and decrease the violation rate. UDOT's Express Lanes comprise one of the longest continuous tolled managed lanes in the country at 72 miles in each direction on I-15 along the urbanized Wasatch Front. Express Lane charges tolls for single occupant use. Clean Fuel Vehicles, carpoolers, motorcycles and buses are also allowed to use the lane for free.

Current violation rates are as high as 28%, which has spurred UDOT to embark on a violation reduction project. To maintain commitments to the taxpayers, legislature and Federal Highway partners, UDOT sees the addition of new technologies to reduce the violation rate another tool in the effort. Through a combination of education, enforcement and technology, UDOT is confident the violation rate will be significantly reduced.

The addition of automated vehicle occupancy detection and reporting systems will provide the data needed for to UDOT's Express Lane network to take great strides towards a smarter system with more sophisticated tolling methods. The accuracy of these detection and reporting units will also provide substantial benefit for day-to-day real-time operational decisions. Enforcement decisions will be made easier by pinpointing the locations where single occupant vehicles are most prevalent.

DEPLOYMENT PLAN

The successful deployment of a set of connected but disparate projects, tied together by the guiding principle of Utah Connected, is a complex undertaking that must be lead by a solid and clear Deployment Plan, agreed upon by all parties and project team members. In this matrix presented on page 17, UDOT presents our approach to the management of the program and all projects that comprise the program, coordination with partners, procurement, development, deployment, operations and maintenance and future enhancements. This matrix provides the major tasks under each of the projects, categorized into general areas of project execution.

Deployment Plan

Package	**Package 1: Rural Foundational Technology**					**Package 2: Connected Vehicles Realized**		**Package 3: Data and Information Sharing**	
Project	**1.1 Fiber I-15**	**1.2 VSL I-15**	**1.3 RWIS / Cameras I-15**	**1.4 VMS I-15**	**1.5 Smart Corridor US-6**	**2.1 DSRC to Enhance and Expand CV Corridors**	**2.2 DSRC Public Safety**	**3.1 Modernize ATIS Dissemination**	**3.4 EL Violation Verification**
Activity									
Project Management	• Monitor budget and schedule • Manage procurement and contracts • Day to day management • Develop project plan								
Concept of Operations	• Anticipate integration into existing ATMS				• Develop Con Ops • Finalize roadside equipment • Determine fleet participation	• Update Con Ops • Determine fleet participation	• Update Con Ops • Determine fleet participation	• Integrate recent research /strategic planning • Develop ConOps	• Develop ConOps
Preliminary Design	• Prepare prelim design				• Prepare prelim roadside design • Secure fleet participation	• Prepare prelim roadside design • Secure fleet participation	• Prepare prelim roadside design • Secure fleet participation	• Develop requirements	• Finalize requirements • Prepare RFP • Select Vendor
Final Design	• Prepare final design • Issue for bid				Prepare final roadside design • Issue for bid • Plan for installation of fleet OBU	• Prepare final roadside design • Issue for bid • Plan for installation of fleet OBU	• Prepare final roadside design • Issue for bid • Plan for installation of fleet OBU	• Develop system documentation	• Develop final design
Development	• Configure ATMS software for control of new equipment	• Update VSL algorithm • Configure ATMS	• Configure ATMS	• Update VMS messages • Configure ATMS	• Procure OBU • Conduct FAT for field and OBU • Update CV applications	• Procure OBU • Conduct FAT for field and OBU • Update CV applications	• Procure OBU • Conduct FAT for field and OBU • Update CV applications	• Procure software and hardware • Develop • software	• Configuration
Installation and Commissioning	• Install comm. network • Unit testing • Commission testing	• Install field equipment • Unit testing • Commission testing			• Install field equipment & OBU • Unit testing for field & OBU • Commission testing for field & OBU	• Install field equipment & OBU • Unit testing for field & OBU • Commission testing for field & OBU		• Unit testing • FAT • Commission testing	
Integration	• Connect new fiber to network	• Connect to field equipment			• Connect to CV applications	• Connect to CV applications	• Link to network	• Link to existing network / legacy comm	• Link to network and central system
Testing	• Integration Testing • VLS Testing				• Integration testing • Conductivity testing	• Integration testing • Conductivity testing	• Integration testing	• Integration testing	• Integration Testing
Acceptance	• Acceptance Testing				• Acceptance Testing	• Acceptance Testing	• Acceptance Testing	• Acceptance Testing	• Acceptance Testing
Initial Operations	• Begin operations • Monitor & adjust • Regression testing				• Begin operations • Monitor & adjust • Regression testing	• Begin operations • Monitor & adjust	• Begin operations • Monitor & adjust	• Begin operations • Monitor & adjust	• Begin operations • Monitor & adjust
O&M	• UDOT responsible for O&M				• UDOT responsible for O&M	• Signals under UDOT control • UDOT responsible for CV O&M	• UDOT responsible for O&M	• UDOT responsible for O&M	• Vendor supported O&M • UDOT enforcement program
Evaluation	• Project data collection • Evaluation report • Report generation								

PROJECT DELIVERABLES

A summary list of project deliverables from the schedule is presented in Table 1.

Table 1 Project Deliverables Placeholder

Project	Milestone Deliverable	Approximate Date
Program Management	Kick-off Meeting*	October, 2017
	Scope and Schedule Management Plan	Six Weeks after award
	Final Project Schedule	Six Weeks after award
	Project Management Support Contractor Award	March, 2018
	Progress Reports	Monthly (following NTP)
	Report to the Secretary	Annually
1.1 Fiber I-15 & 1.2 VSL I-15	Project Kick-off Meeting	January, 2018
	Final Design Package Issue for Bid	September, 2018
	Contractor Award	November, 2018
	System Development and Configuration Acceptance	July, 2019
	Final Acceptance	September, 2019
	Begin Operations	October, 2019
1.3 RWIS/ Cameras I-15 & 1.4 VMS I-15	Project Kick-off Meeting	June, 2019
	Final Design Package Issue for Bid	September, 2019
	Contractor Award	November, 2019
	System Development and Configuration Acceptance	March, 2020
	Final Acceptance	May, 2020
	Begin Operations	June, 2020
1.5 Smart Corridor US-6	Project Kick-off Meeting	June, 2019
	Concept of Operations	September, 2019
	Final Design Package Issue for Bid	December, 2019
	Contractor Award	February, 2020
	Factory Acceptance Testing OBU and Field Equipment	June, 2020
	Final Acceptance	August, 2020
	Begin Operations	September, 2020
2.1 DSRC to Enhance & Expand CV Corridors	Project Kick-off Meeting	December, 2017
	Concept of Operations	March, 2018
	Bus OBU Installation Plan	April, 2018
	Contractor Award (Bus OBU Installations)	March, 2018
	Final Corridor Design Package Issue for Bid	June, 2018
	Factory Acceptance Testing Bus OBU	January, 2019
	Contractor Award (Corridors)	January, 2019
	Contractor Award (Snow Plow OBU Installations)	June, 2019
	Factory Acceptance Snow Plow OBU and Corridor Field Equipment	August, 2019
	Final Acceptance Full Solution	November, 2019
	Begin Full Operations	January, 2020

Project	Milestone Deliverable	Approximate Date
2.2 DSRC Public Safety	Project Kick-off Meeting	January, 2020
	Concept of Operations	February, 2020
	Final Design Package Issue for Bid	April, 2020
	Contractor Award	June, 2020
	Final Acceptance	August, 2020
	Begin Operations	September, 2020
3.1 Modernize ATIS Dissemination	Project Kick-off Meeting	January, 2018
	Concept of Operations Update	March, 2018
	Final Design Package Issue for Bid	June, 2018
	Contractor Award	August, 2018
	Factory Acceptance Testing	March, 2019
	Final Acceptance	May, 2019
	Begin Operations	June, 2019
3.2 EL Violation Verification	Project Kick-off Meeting	July, 2018
	Concept of Operations	September, 2018
	Final Design Package Issue for Bid	January, 2019
	Contractor Award	March, 2019
	Integration Testing	October, 2019
	Final Acceptance	December, 2019
	Begin Operations	January, 2020

**Note: Notice To Proceed (NTP) is assumed to be issued January, 2018. The early Kick-off will allow for program management work to commence so that planning and management is in hand before the first project begins.*

OBSTACLES TO DEPLOYMENT

For the past two decades, UDOT has been laying the groundwork, literally and figuratively, to be able to successfully implement large-scale transportation technology projects. This strong foundation has led UDOT to its current position where it faces few regulatory, legislative or institutional obstacles to deploying ***Utah Connected.*** However, in any project risk and potential obstacles must be identified, and to that end there are several deployment challenges that will be considered for mitigation as the program goes forward:

Legislative

The impact of legislative restrictions on use of individual traveler data is an issue to consider. Until recently, government agencies in Utah were restricted from directly collecting individual traveler data (e.g. Bluetooth) from citizens, even in aggregate form with no identifying characteristics. A few years ago, UDOT successfully worked to change some of the specifics of this rule. While the restrictions have been softened, it is still an issue that may need to be addressed. We do not anticipate a need for such data as part of this program but there implications as connected vehicles come on line.

Institutional

With a full time staff position dedicated to the development of innovative projects, as well as one fully dedicated to fiber management, plus consultant support in both areas, institutional risk to successful deployment is especially low for UDOT.

Technological

One of the strengths of the proposed program is its mix of foundational and new technologies that combined demonstrate a replicable approach to the ITS corridors of today and tomorrow. Within that scope, however, are several very new technologies that have not been widely deployed, such as emerging CV applications. UDOT will work closely with the chosen vendors and other agencies who have deployed these technologies to verify their readiness for implementation.

Public Perception

UDOT enjoys consistently high public approval ratings; in fact ratings of UDOT's handling of public funds and operational performance is as positive as any other DOT in the country. A focus on the privacy of personal data is an issue to which UDOT is attuned. UDOT manages one of the oldest 511 traveler information systems in the country, and dedicates resources to staying current on advances and improvements in the technology that supports ATIS. Through these efforts, UDOT has come to understand and consider the importance of privacy among the residents of Utah. While the methods by which data collection and dissemination expand regularly, and the expectations of the public for real-time, accurate information increase as well, UDOT will take into account the balance that must be achieved in providing updated information services to the public, while respecting their privacy needs.

QUANTIFIABLE SYSTEM PERFORMANCE IMPROVEMENTS AND PROJECTIONS

The benefits of investments in transportation technology must be captured with quantifiable system performance metrics. However, measuring these benefits from improved information has been a challenge. UDOT has successfully developed and routinely uses freeway performance metrics, traffic signal performance metrics, and snow plow performance criteria. The following table offers a list by program element of measures and projected impacts that will form the basis of the program evaluation.

Program Elements	Measures	Projections
Package 1: Rural Foundational Technology		
1.1 Fill fiber gaps along southern I-15	• Install and Commission	• Operational Network
1.2 Install I-15 Variable Speed Limit (VSL) System	• Winter Crashes • Speed differential	• ~ 5% reduction • Less speed variability
1.3 Install Additional RWIS and Cameras in Rural I-15 Locations	• Winter Crashes • Snow Removal	• Fewer Crashes • Less unacceptable snow removal
1.4 Install Variable Message Signs (VMS) along I-15 in southern Utah	• Secondary Crashes • Reduced Speed during incidents	• Fewer Crashes • Less variability
1.5 Implement Rural US 6 Smart Corridor Improvements	• Winter Crashes • Speed differential • Snow Removal	• ~ 5% reduction • Less speed variability • Less unacceptable snow removal
Package 2: Connected Vehicles Realized		
2.1 Enhance and Expand Operational CV Arterial Corridors		
2.1a Equip 5600 W and 8400 W CV Corridors	• Schedule Reliability	• Operational CV corridor
2.1b Equip more buses with DSRC OBU Units	• Schedule Reliability	• More on schedule trips for equipped vehicles
2.1c Equip Snow Plows with DSRC OBU Units	• Reliability • Snow Removal	• More on reliable trips for equipped vehicles • Less unacceptable snow removal
2.2 Implement CV Applications for public safety		
2.2a Enable Pedestrian Crossing Applications	• Accuracy	• 95%+ operational accuracy
2.2b Enable Red Light Violations Warning	• Accuracy	• 99%+ accuracy under controlled tests • 95%+ operational accuracy
Package 3: Data and Information Sharing		
3.1 Modernize Advanced Traveler Information Dissemination	• System usage • Feedback • Focus groups • State of the industry • Future system expansion	• Increase in usage levels • Decrease in volume of feedback • Positive feedback from focus group participants • Reduce delay through excellent dissemination of traveler information • Increase knowledge and use of traveler information resources by 10% • Empower the traveler to plan their travel to avoid delay
3.2 Express Lanes Violation Verification	• Violation Rate	• ~10% reduction in violations

VISION, GOALS, AND OBJECTIVES

The principles that guide UDOT are proactively shared with the public as well as UDOT staff. Every year, UDOT has produced a Strategic Direction document to provide the taxpayers of Utah information on how public funds are being invested by the agency. UDOT's vision, goals and objectives are provided in that Strategic Direction document, a brochure up to 2016 but now fully interactive online at udot.utah.gov.

UDOT's vision is as simple and straightforward as its name. Keep Utah Moving. Our mission is: Innovating transportation solutions that strengthen Utah's economy and enhance quality of life.

The growing demand on Utah's transportation system is substantial, and finding ways to meet those demands, while keeping our current system running, requires resourcefulness and innovative thinking, which are key values of the agency and reflected in the program UDOT has proposed for this application.

The goals supporting this departmental mission include the following

- **Zero Crashes, Injuries and Fatalities:** UDOT's commitment to safety is supported by the proposed program which will provide roadside warnings via VMS, CV safety applications, CV red light violation warnings, and improved communications infrastructure to remote rural areas.
- **Preserve Infrastructure:** The application of technology along the program's roadways improves the efficiency of the existing infrastructure investment, and the ongoing investment helps to ensure that they are maintained.
- **Optimize Mobility:** In addition to adding capacity where warranted, UDOT optimizes traffic mobility by incorporating innovative design and traffic management strategies, as demonstrated by its past successes in ITS deployments and performance metrics. These strategies will be enhanced with the packages in this proposal.

Within UDOT, the Traffic Management Division's missions also include the following, which are supported by the program packages as shown:

Traffic Management Division Missions	Supporting Packages		
	Package 1: Rural Foundational Technology	Package 2: Connected Vehicles Realized	Package 3: Data and Information Sharing
1. Improve highway safety	•	•	•
2. Improve the efficiency of Utah's highways	•	•	•
3. Provide timely and accurate real-time traffic information			•
4. Facilitate cooperative public and private partnerships that integrate transportation services	•	•	•
5. Provide customer service directly to the public on the operation of the transportation system			•

PARTNERING PLAN

UDOT has spent years carefully developing relationships with local municipalities and transit agencies, for the purpose of erasing the regular jurisdictional boundaries that challenge successful deployments of public services. UDOT overcame opposition by partner agencies to share a common central signal system but is now one of the few agencies in the country to have multiple owners on one network. The benefits to the public are great and include better signal coordination across jurisdictional boundaries, less wait time, faster response for retiming and other benefits. This organization of city, county, and transit agencies with UDOT share a common traffic signal control system that connects 89% of all of the traffic signals in the State. This physical connection and transparency across jurisdictions fosters close coordination with open lines of communication.

Our partnership with UTA in particular will be a central element in the success of Package 2. The addition of new DSRC units on UTA transit vehicles will expand the already successful operation of signal priority for transit vehicles on arterials. In addition to partnerships and working relationships with public agencies, UDOT is well equipped to enlist the support of various telecom providers, consultants, and equipment vendors. UDOT plans to continue to leverage its relationships with private fiber communications companies for the urban and rural fiber elements in this project. UDOT has had significant past success negotiating with these companies for mutually-beneficial fiber asset trades and partnerships. UDOT maintains on-call agreements with consultants in various specialties such as signal design and deployment, ITS planning, consulting, and marketing. Table 2 provides a list of the potential partners with whom UDOT has existing relationships and/or contracts. All entities on this list can be, and are planned to be, enlisted to participate in the successful execution of ***Utah Connected.***

Table 2 Available Partners

Company/Firm/Vendor	Areas of Expertise
Telecoms	
South Central Communications	Fiber, Telecom
CentraCom	Fiber, Telecom
Emery Telecommunications	Fiber, Telecom
Strata Networks	Fiber, Telecom
Beehive Telecommunications	Fiber, Telecom
Consultants	
The Narwhal Group	ITS Systems Engineering, Connected Vehicle systems, Software Design
Pinetop Engineering	ITS Systems Engineering, Traffic Engineering, Signal Design, Traffic Modeling
Horrocks Engineers	Fiber and ITS Design
Intrepid	Public Outreach, Marketing
IBI	ITS Design, Software Design, Project Management
Equipment Vendors	
Wavetronix	Smart sensors, radar
Intelight	Traffic Control Cabinets and Controllers

Company/Firm/Vendor	Areas of Expertise
Savari	Analytics Software, DSRC Systems
Daktronics	VMS equipment
Wanco	Traffic safety equipment
Lear	DSRC Systems
Data	
Third-party Data Provider * * Procurement for third-party data provider is in the final stages	Traffic event, congestion, and travel time data

EXISTING TECHNOLOGY INVESTMENTS

UDOT has made significant and sustained investment in technology and ITS infrastructure, services and products. In fact, UDOT is known as an organization that encourages innovative action, and has provided resources and investments to support it. We have been involved in connected vehicle planning and implementation for fifteen years through various TRB, FHWA and AASHTO committees and panels, and are actively working to bring these new technologies to fruition on our infrastructure. Our commitment to connected vehicle deployment is evidenced by the DSRC infrastructure on the Redwood Road corridor. As the first state DOT to employ design-build techniques on large highway infrastructure, we have continued to break new ground with accelerated bridge construction, innovative intersections (diverging diamonds, continuous flow interchanges, and thru-turns), traffic signal performance measurement, road weather performance management, and truck platooning testing. Other technology investments made in support of advanced transportation management initiatives include:

Fiber Connectivity

Fiber optics has changed the way that UDOT communicates. A total of 2200 miles of fiber reaches into every corner of the state with high-speed, dedicated point-to-point connections. The fiber optic highway network connects a broad range of traffic devices, and UDOT is working towards a goal of border-to-border fiber connectivity on I-15. This connectivity facilitates efficient movement of real-time data on a private closed network enabling secure and confidential data transfers. Cooperative relationships with private telecommunication companies allows UDOT to provide independent communication paths for traffic data over this expansive network. These fiber partnerships also facilitate high-speed internet service being made available to rural and underserved communities.

Signal Interconnectivity

Statewide

Of the 1990 total traffic signals in the state of Utah, 1788 of them (89%) are connected to our central traffic control system. We are dedicated to our goal of reaching 100% connectivity, of all traffic signals statewide. Connected signals include those in both urban and rural areas, with some as far as 300 miles away from the Traffic Operations Center. About two-thirds of these signals are state-owned; the remainder are owned and maintained by local counties and cities. On our central system, ownership is transparent; the management of signals is accomplished seamlessly across all jurisdictional boundaries. .

Salt Lake Metro Area

Within the Salt Lake metropolitan area, 97% of UDOT's 511 signals are connected to the central system. UDOT owns most of the major arterials in the area. Since County and City signals are about 78% connected today, the overall metro area connectivity is 87%.

Data

Intersection Data

The UDOT Signal Performance Metrics project gathers and stores real-time, high-resolution data from 1650 signalized intersections throughout the state. UDOT is the national leader in signal performance measurement. Primarily using radar detection, intersection data includes signal phase, split monitor, arrivals on red, approach volumes and speeds, turning movement counts, pedestrian call delays, and pre-emption calls. This data is all viewable at: http://udottraffic.utah.gov/signalperformancemetrics/.

Freeway Data

Volume, occupancy and speed data is available on interstate corridors in the urban areas, usually at half-mile spacing. Since 95% of UDOT's detectors are operational, this data is reliable and accurate. UDOT is compiling some of that data to identify the causes of congestion along Interstate 15. This graphic data can be viewed at: http://udottraffic.utah.gov/freewayperformancemetrics/.

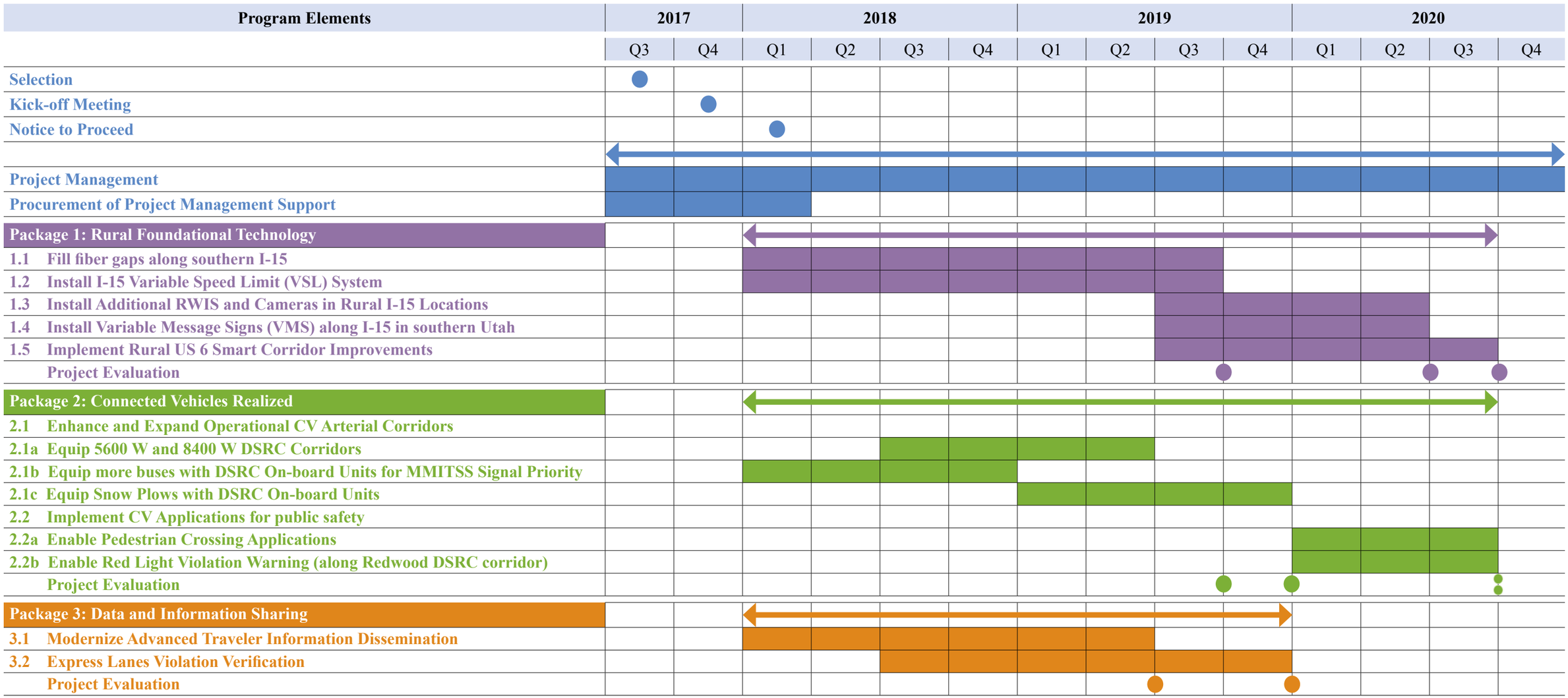
Connected Vehicles

UDOT is close to completing the deployment of DSRC roadside equipment along a busy arterial corridor in Salt Lake County, Redwood Road. In the beginning, these devices will broadcast Signal Phase and Timing (SPaT) and MAP data at each intersection to support a smart bus transit priority system using the Multi-Modal Intelligent Traffic Signal System (MMITSS) software. As part of this deployment, an evaluation of the effectiveness of this new priority system in real traffic will be performed. This corridor also provides a framework for other connected vehicle applications to be tested and operated by UDOT or other parties.

PROGRAM SCHEDULE

The UDOT team created a detailed Project Schedule to support a staggered deployment of all program elements. General assumptions made to develop this schedule include:

- Selection is made in September 2017
- Kick-off Meeting is held at UDOT in October, 2017
- Award and Notice to Proceed is provided in January, 2018


Program Elements
2017
2018
2019
2020
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Selection
Kick-off Meeting
Notice to Proceed
Project Management
Procurement of Project Management Support
Package 1: Rural Foundational Technology
1.1 Fill fiber gaps along southern I-15
1.2 Install I-15 Variable Speed Limit (VSL) System
1.3 Install Additional RWIS and Cameras in Rural I-15 Locations
1.4 Install Variable Message Signs (VMS) along I-15 in southern Utah
1.5 Implement Rural US 6 Smart Corridor Improvements
Project Evaluation
Package 2: Connected Vehicles Realized
2.1 Enhance and Expand Operational CV Arterial Corridors
2.1a Equip 5600 W and 8400 W DSRC Corridors
2.1b Equip more buses with DSRC On-board Units for MMITSS Signal Priority
2.1c Equip Snow Plows with DSRC On-board Units
2.2 Implement CV Applications for public safety
2.2a Enable Pedestrian Crossing Applications
2.2b Enable Red Light Violation Warning (along Redwood DSRC corridor)
Project Evaluation
Package 3: Data and Information Sharing
3.1 Modernize Advanced Traveler Information Dissemination
3.2 Express Lanes Violation Verification
Project Evaluation

LEVERAGING US DOT ITS INITIATIVES

The proposed program ties in closely with three of the US DOT's priority ITS initiatives: Connected Vehicles and Rural Technology Deployments.

These principles will be applied through the improvements identified for I-15 and US 6, as well as the new rural smart corridors 5600 W and 8400 W.

On the CV front, this program will expand and build upon significant investments in a variety of test beds and deployment nationwide. We plan to expand our program in alignment with the goals and progress of USDOT deployments. The state of Utah offers a unique combination of both the rural and urban environments being tested at these locations, as well as a four-season climate and prior experience implementing connected vehicle technologies on the Redwood Road corridor. This program will provide additional real-world deployment experience, data and lessons learned as an operational CV arterial corridor that can be added and leveraged by the existing test beds and other sites nationwide.

While the Salt Lake City region is urban, much of the rest of the State is very rural. This initiative calls for the deployment of advanced transportation technologies in rural areas. Package 1 of this program is focused on installing communications, cameras, VMS, VSL, and traffic sensors in two rural corridors.

STAFFING DESCRIPTIONS

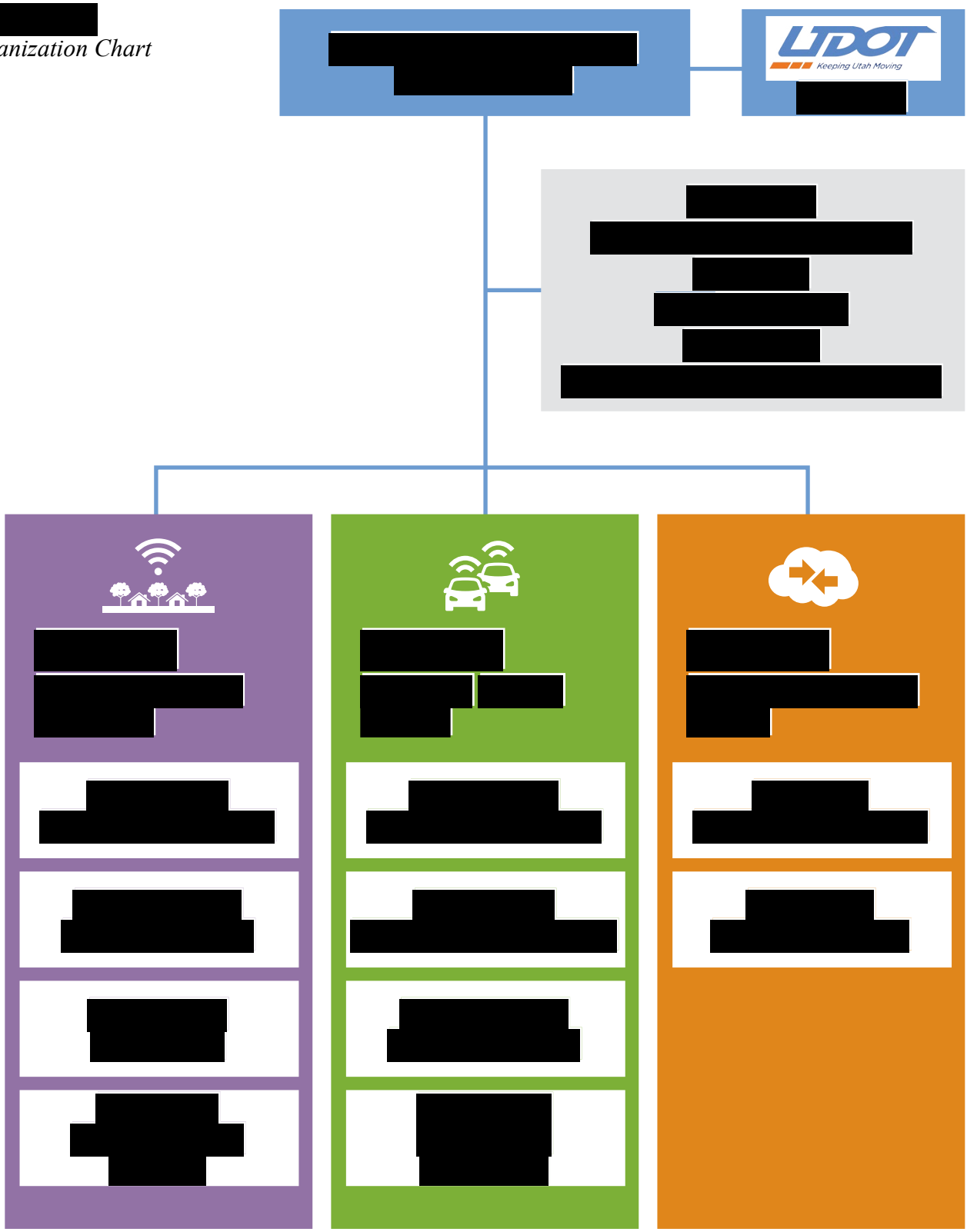
[redacted]

PROGRAM ORGANIZATION

Utah Connected is comprised of three packages, and nine projects within those packages. Our proposed program organization takes advantage of the tremendous depth of resources and expertise available in our Traffic Management Division, staffed with highly motivated professional personnel. [redacted]

[redacted]

Organization Chart



KEY STAFF

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Appendix A – Resumes

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