1. Award No.
693JJ31850001

2. Effective Date
See No. 17 Below

3. CFDA No.
20.200

4. Award To

City and County of Denver
201 W. Colfax
Suite 509
Denver, CO 80202-5329

DUNS No.: 085596802
TIN No.: 84-6000580

5. Sponsoring Office

U.S. Department of Transportation
Federal Highway Administration
Office of Acquisition & Grants Management
1200 New Jersey Avenue, SE
HCFA-32, Mail Drop E62-204
Washington, DC 20590

6. Period of Performance

Forty-Eight (48) Months

7. Total Amount

Federal Share:	$6,000,007
Recipient Share:	$6,000,007
Total:	**$12,000,014**

8. Type of Agreement

Cooperative Agreement

9. Authority

23 U.S.C. 503(c)(4)

10. Procurement Request No.

HOTMXX1700000099

11. Funds Obligated

$6,000,007

12. Submit Payment Requests To

See "Payment" clause in General Terms and Conditions

13. Payment Office

See "Payment" clause in General Terms and Conditions

14. Accounting and Appropriations Data

15X044A060.0000.070N44A600.7001000000.41011.61006600 - Total Obligated = **$6,000,007**

15. Research Title and/or Description of Project

"Denver Smart City Program"

16. City and County Denver

_____

Signature Date
Name:
Title:

17. Federal Highway Administration

_____

Signature Date
Name: Stephanie Curtis
Title: Agreement Officer

Table of Contents

ATTACHMENT(s):

1. Technical Application, “Denver Smart City Program" (39 pages)
2. City and County of Denver's Budget - SF 424A (3 pages)
3. Project Oversight Agreement (12 pages)

SECTION A - AGREEMENT DESCRIPTION

A.1 STATEMENT OF PURPOSE

The Federal Highway Administration (FHWA) hereby enters into this Cooperative Agreement (Agreement) with the City and County of Denver (Recipient) to develop model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment. These model deployments are expected to provide benefits in the form of:

- reduced traffic-related fatalities and injuries;
- reduced traffic congestion and improved travel time reliability;
- reduced transportation-related emissions;
- optimized multimodal system performance;
- improved access to transportation alternatives, including for underserved populations;
- public access to real time integrated traffic, transit, and multimodal transportation information to make informed travel decisions;
- cost savings to transportation agencies, businesses, and the traveling public; or
- other benefits to transportation users and the general public.

The purpose of this Agreement is to promote the use of innovative transportation solutions. The deployment of these technologies will provide Congress and the United States Department of Transportation (DOT) with valuable real life data and feedback to inform future decision making.

A.2 LEGISLATIVE AUTHORITY

Specific statutory authority for conducting this effort is found in 23 U.S.C. §503(c)(4), which authorizes the Secretary of Transportation to "…establish an advanced transportation and congestion management technologies deployment initiative to provide grants to eligible entities to develop model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment."

Per 23 U.S.C. §503(c)(4)(I)(i), funding for this effort is available from amounts authorized under §6002(a)(1), §6002(a)(2), and §6002(a)(4) of Public Law 114-94, the Fixing America's Surface Transportation Act (FAST).

The authority to enter into a cooperative agreement for this effort is found under 23 U.S.C. §502 - Surface Transportation Research, Development, and Technology, paragraph (b)(3) which states:

> "(3) **cooperation, grants, and contracts. —** The Secretary may carry out research, development, and technology transfer activities related to transportation—

(A) independently;
(B) in cooperation with other Federal departments, agencies, and instrumentalities and Federal laboratories; or
(C) by making grants to, or entering into contracts and cooperative agreements with one or more of the following: the National Academy of Sciences, the American Association of State Highway and Transportation Officials, any Federal laboratory, Federal agency, State agency, authority, association, institution, for-profit or nonprofit corporation, organization, foreign country, or any other person."

Per 23 U.S.C. §503(c)(4)(J), the Federal share of the cost of a project for which a grant is awarded under this subsection shall not exceed 50 percent of the cost of the project.

A.3 BACKGROUND

States and jurisdictions across the country are tackling transportation challenges that often result in congestion and unreliable travel for people and goods, negative impacts on the environment, and reduced safety for users and vehicles. According to the Texas A&M University Transportation Institute, Americans spend on average over 40 hours per person stuck in traffic each year for an annual financial cost of $121 billion. Research indicates that cities account for 67% of all greenhouse gases (GHGs) released into the atmosphere, and the transportation sector is the second-biggest source of GHG emissions, responsible for emitting 28% of GHGs into the atmosphere. There were 32,675 deaths and more than 2.3 million injuries from vehicle crashes in 2014, and there were more than 6.1 million reported motor vehicle crashes. Recognizing that implementing technology solutions can help address transportation safety, mobility, and air quality challenges, section 6004 of the FAST Act establishes the advanced transportation and congestion management technologies deployment initiative.

Projects funded under this initiative will deploy advanced transportation and congestion management technologies, including:

i. **Advanced traveler information systems** – Systems that provide real time, predicted, and individualized information about travel choices, based on data from sensors (traffic, weather), mobile sources (personal portable devices, connected vehicles), and other information systems (public transportation, shared-use mobility, traffic incident management, construction, parking, congestion pricing/tolls or other costs) to allow travelers and shippers to make informed decisions regarding destinations, when to travel, routes, or modes. This information should be publicly accessible and not limited to users with smart phones.
ii. **Advanced transportation management technologies** – Technologies that assist transportation system operators in managing and controlling the performance of their systems to provide optimal services or respond to dynamic conditions, including interjurisdictional and intermodal coordination; technologies may include traffic signal equipment, advanced data collection and processing (from sensors, connected vehicles and other mobile sources, other information systems), dynamic lane controls/configurations, and cooperative transportation management algorithms including pricing strategies across jurisdictions/agencies/facilities/modes.
iii. **Infrastructure maintenance, monitoring, and condition assessment** – Technologies and systems that monitor the behavior or assess the condition of transportation infrastructure to

allow agencies to better manage their transportation assets through optimizing resource allocation, preventative maintenance processes, and responses to critical conditions.

iv. **Advanced public transportation systems** – Technologies that assist public transportation system operators or other shared mobility entities in managing and optimizing the provision of public transportation and mobility services; technologies may include remote fleet monitoring systems, coordinated communication systems, algorithms, and applications to enable better transit connections for users, advanced data collection and processing (from sensors, mobile/connected sources, other information systems) to provide dynamic responsive transit services, and communication and data systems that enable shared mobility services.

v. **Transportation system performance data collection, analysis, and dissemination systems** – Technologies and systems that actively monitor the performance of and interactions between transportation systems and permit agencies and other interested entities to conduct analyses and research, and explore innovative, value-added products and services.

vi. **Advanced safety systems, including vehicle-to-vehicle and vehicle-to-infrastructure communications, technologies associated with autonomous vehicles, and other collision avoidance technologies, including systems using cellular technology** – Deployment of technology-based safety systems such as described at Safer Car (http://www.safercar.gov/) or at the Intelligent Transportation Systems (ITS) Program (http://www.its.dot.gov/landing/safety.htm), or other applicable safety technologies.

vii. **Integration of intelligent transportation systems with the Smart Grid and other energy distribution and charging systems** – Technologies that link information from ITS and other transportation systems with information from Smart Grid and other energy distribution and charging systems to provide users with better information related to opportunities for recharging electric vehicles, and to provide energy distribution agencies with better information related to potential transportation-user demand.

viii. **Electronic pricing and payment systems** – Technologies that permit users to electronically conduct financial transactions for mobility services across jurisdictions and agencies, such as unified fare collection, payment, and tolling systems across transportation modes; or

ix. **Advanced mobility and access technologies, such as dynamic ridesharing and information systems to support human services for elderly and disabled individuals** – Technologies and systems that leverage data and communications systems to allow public agencies and human service organizations to provide improved mobility services to at-risk users such as elderly, disabled, or other individuals that require transportation assistance.

Advanced technologies can also help to revitalize neighborhoods and regions by attracting more business or residential developments to bring opportunities closer to where people live. Technologies also help provide transportation options and improved multimodal transportation systems, allowing users to have access to safe, reliable, and affordable connections to employment, education, healthcare, goods delivery, and other services. As such, technology helps create pathways to jobs and economic opportunity for traditionally disadvantaged populations.

ITS are laying the groundwork for innovative transportation solutions, with many locations currently serving as laboratories for new types of transportation services. Integrating ITS, connected vehicle technologies, automated vehicles, and other advanced technologies within the context of a jurisdiction or region provides enhanced travel experiences and makes moving people and goods safer, more efficient, and more secure. By enhancing the effective management and operation of the transportation system,

these solutions can leverage existing infrastructure investments, enhance mobility, sustainability, and livability for citizens and businesses, and greatly increase the attractiveness and competitiveness of jurisdictions and regions.

A.4 VISION, GOALS, AND FOCUS AREAS

The DOT's vision for the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) initiative is the deployment of advanced technologies and related strategies to address issues and challenges in safety, mobility, sustainability, economic vitality, and air quality that are confronted by transportation systems owners and operators. The advanced technologies are integrated into the routine functions of the location or jurisdiction, and play a critical role in helping agencies and the public address their challenges. Management systems within transportation and across other sectors (e.g., human services, energy, and logistics) share information and data to communicate between agencies and with the public. These management systems provide benefits by maximizing efficiencies based on the intelligent management of assets and the sharing of information using integrated technology solutions. The advanced technology solutions and the lessons learned from their deployment are used in other locations, scaled in scope and size, to increase successful deployments and provide widespread benefits to the public and agencies.

Goals for the ATCMTD program include:

- Reduced costs and improved return on investments, including through the enhanced use of existing transportation capacity;
- Delivery of environmental benefits that alleviate congestion and streamline traffic flow;
- Measurement and improvement of the operational performance of the applicable transportation networks;
- Reduction in the number and severity of traffic crashes and an increase in driver, passenger, and pedestrian safety;
- Collection, dissemination, and use of real time transportation related information to improve mobility, reduce congestion, and provide for more efficient and accessible transportation, including access to safe, reliable, and affordable connections to employment, education, healthcare, freight facilities, and other services;
- Monitoring transportation assets to improve infrastructure management, reduce maintenance costs, prioritize investment decisions, and ensure a state of good repair;
- Delivery of economic benefits by reducing delays, improving system performance and throughput, and providing for the efficient and reliable movement of people, goods, and services;
- Accelerated deployment of vehicle-to-vehicle, vehicle-to-infrastructure, and automated vehicle applications, and autonomous vehicles and other advanced technologies;
- Integration of advanced technologies into transportation system management and operations;
- Demonstration, quantification, and evaluation of the impact of these advanced technologies, strategies, and applications towards improved safety, efficiency, and sustainable movement of people and goods; and
- Reproducibility of successful systems and services for technology and knowledge transfer to other locations facing similar challenges.

A.5 STATEMENT OF WORK

The Recipient shall execute their proposed work plan as detailed in Attachment 1.

A.6 DELIVERABLES

The Recipient shall provide the deliverables detailed in Attachment 1 and the following items:

*Award date is shown on page 1, Block 17, FHWA signature date.

Deliverable	Approximate Due Date	Section 508 Compliant?
Kick-off Meeting Conduct a kick-off meeting with FHWA at mutually-agreed-upon location.	Within 4 weeks after award	No
Quarterly Progress Reports Submit progress reports to document activities performed, anticipated activities, and any changes to schedule or anticipated issues.	Quarterly in accordance with Section C, Item 3. Reporting	No
Project Management Plan The Recipient shall submit to FHWA for approval a Project Management Plan, which shall include, at a minimum: a) **Statement of Work**, with a description of **Tasks and Sub-Tasks** by which the project work activities will be organized, executed, and monitored. b) A **Project Schedule** (Gantt Chart or equivalent) displaying begin and end times for each Task and Sub-Task, plus achievement of Project Milestones. c) A description of major **Project Milestones**, including key Reports, start of operations of important systems or subsystems, and other important deliverables or events. d) A **Staffing** Table, which identifies a single Project Manager, plus project staff and/or consultants that will lead and support each Task (or Sub-Task if appropriate). e) A **Project Budget**, displaying planned expenditures for each Task, with a further breakdown by Cost Element for each Task, and by the federal share vs. non-federal share.	Within 60 days after award	No

Systems Engineering Documents In accordance with 23 CFR 940.11, the Recipient shall submit electronic copies of the milestone Systems Engineering documents applicable to this project, for approval by FHWA. This shall include, at a minimum: a) Concept of Operations (ConOps); b) Systems Engineering Management Plan (SEMP); & **c)** Other System Engineering Analysis Documents.	As applicable	No
Project Evaluation Plan. The Recipient shall submit to FHWA for approval an Evaluation Plan, which shall include, at a minimum: i. Statement of **Project Objectives**, ii. List of **Evaluation Criteria** (e.g. quantitative performance metrics and/or qualitative assessments) tailored to the Project Objectives, iii. Description of **data-collection** procedures tailored to these criteria, which could include, for example, before/after data, surveys, interviews, system-monitoring data, or other data needed to report on achievement of project objectives. iv. Outline of **Evaluation Report** (1-page, draft list of topics to be addressed)	Within 90 days after award	No
Report to the Secretary Submit a report to the Secretary that describes: a. Deployment and operational costs of the project compared to the benefits and savings the project provides; and b. How the project has met the original expectations projected in the deployment plan submitted with the application, such as: 1. data on how the project has helped reduce traffic crashes, congestion, costs, and other benefits of the deployed systems; 2. data on the effect of measuring and improving transportation system performance through the deployment of advanced technologies; 3. the effectiveness of providing real time integrated traffic, transit, and multimodal transportation information to the public to make informed travel decisions; and 4. lessons learned and recommendations for future deployment strategies to optimize transportation efficiency and multimodal system performance.	Annually beginning one year after the award date	Yes

Final Report The Recipient shall provide a final report within ninety (90) days after the termination or expiration of this Agreement. The FHWA Agreement Officer Representative (AOR), in consultation with the Recipient, will determine the final design and scope of the evaluation and report. Submit an electronic copy of all reports to the ATCMTD mailbox at ATCMTD@dot.gov, and to jeffrey.d.martin@dot.gov , dave.harris@dot.gov, peter.huang@dot.gov, and patricia.sergeson@dot.gov	Within 90 days after the termination or expiration of this Agreement	No

Note: Section 508 requirements are available online at: http://www.fhwa.dot.gov/aaa/generaltermsconditions.cfm.

SECTION B – AWARD INFORMATION

B.1 TYPE OF AWARD

This award is a cost reimbursement Cooperative Agreement (Agreement).

B.2 AVAILABLE FUNDING

The total amount of Federal funding that may be provided under this Agreement is identified on Page 1 of this Agreement in Item 7, for the entire period of performance, subject to the limitations shown below:

a. Currently, Federal funds identified on Page 1 of this Agreement, Items 11 and 14, are obligated to this Agreement. This Agreement is fully funded.
b. The FHWA's liability to make payments to the Recipient is limited to those funds obligated under this Agreement.

B.3 COST SHARING OR MATCHING

Cost sharing or matching is required, with the maximum Federal share being 50%; therefore, a minimum non-federal cost share of 50% is required. Cost sharing or matching means the portion of project costs not paid by Federal funds. For a more complete definition, please see the Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards at 2 CFR Part 200, including section 200.306 on Cost Sharing or matching. Other Federal funds using their appropriate matching share may be leveraged for the deployment but cannot be considered as part of the ATCMTD matching funds, unless otherwise supported by statute.

The Recipient's match can be met through direct financial support or through "in-kind" services. By the completion date of the Agreement, the Recipient must have met the cost-sharing requirement. All cost share contribution must be submitted with sufficient detail and/or documentation to support the fair market value of the contribution. If additional detail and/or documentation are determined necessary in order to verify the contribution, the Recipient will provide the requested information in a timely fashion.

B.4 PERIOD OF PERFORMANCE

The period of performance for this Agreement is delineated on Page 1 in Item 6.

B.5 DEGREE OF FEDERAL INVOLVEMENT

The FHWA anticipates substantial Federal involvement between it and the Recipient during the course of this project. The anticipated Federal involvement will include: technical assistance and guidance to the Recipient; approved actions as defined in Attachment 3 – Project Oversight Agreement; participation in status meetings including kick off meeting and project reviews; review and comment on draft documents, as appropriate; performance reporting and financial reporting to ensure that the objectives and the terms and conditions of the agreement are met; and close monitoring of performance.

SECTION C - AWARD ADMINISTRATION INFORMATION

C.1 FEDERAL AWARD NOTICES

Only the Agreement Officer (AO) can commit the FHWA. The award document, signed by the AO, is the authorizing document. Only the AO can bind the Federal Government to the expenditure of funds.

C.2 GENERAL TERMS AND CONDITIONS

General terms and conditions including payment procedures, compliance requirements for Section 508 of the Rehabilitation Act of 1973 (as amended in 1998), and governing regulations that apply to this Agreement are available online at:

http://www.fhwa.dot.gov/aaa/generaltermsconditions.cfm

C.3 STATUTORY AND NATIONAL POLICY REQUIREMENTS

In addition to the FHWA's General Terms and Conditions incorporated by reference in Section C.2, the Recipient is also required to comply with all applicable U.S. Code: Title 23 requirements, Code of Federal Regulations (CFR): Title 23 requirements, and any other applicable statute or regulation.

C.4 ADDITIONAL TERMS AND CONDITIONS

C.4.A PUBLIC ACCESS TO DOCUMENTS

The Recipient agrees that the resulting deliverables/documentation submitted to the FHWA under this Agreement may be posted online for public access and/or shared by FHWA with other interested parties. The FHWA anticipates the documents cited herein may be posted on an FHWA website or other appropriate website.

C.4.B INDIRECT COSTS

Indirect costs are allowable under this Agreement in accordance with the Recipient's Federally Negotiated Indirect Cost Rates as documented in writing and approved by the Recipient's cognizant Government agency. In the absence of such Government-approved indirect rates, the following rates are hereby approved for use under this Agreement as shown below:

Table C.4.B – Indirect Costs

*Type**	*Indirect Rate*	*Period*	*Rate (%)*	*Base*
Fixed	Labor Overhead Indirect Rate	Indefinite	18.08	Direct Labor & Fringe Benefits

*Types of Rates: Pred - Predetermined; Fixed - Fixed; Final – Final; Prov: Provisional/billing; or De minimus.

In the event the Recipient determines the need to adjust the above listed rates, the Recipient will notify the AO of the planned adjustment and provide rationale for such adjustment. In the event such adjustment rates have not been audited by a Federal agency, the adjustment of rates must be pre-approved in writing by the AO.

This Indirect Cost provision does not operate to waive the limitations on Federal funding provided in this document. The Recipient's audited final indirect costs are allowable only insofar as they do not cause the Recipient to exceed the total obligated funding.

C.4.C DATA RIGHTS

The Recipient must make available to the FHWA copies of all work developed in performance with this Agreement, including but not limited to software and data. Data rights under this Agreement shall be in accordance with 2 CFR 200.315, Intangible property.

C.4.D PERSONALLY IDENTIFIABLE INFORMATION (PII)

Personally Identifiable Information (PII), as defined in 2 CFR §200.79 and 2 CFR §200.82, will not be requested unless necessary and only with prior written approval of the AO with concurrence from the AOR. PII is defined as any information about a human being, living or dead, regardless of nationality, that is maintained by an agency and that permits identification of that individual to be reasonably inferred by either direct or indirect means (as in data mining), including, but not limited to, name, social security number, date and place of birth, mother's maiden name, biometric records, education, financial transactions, medical history, non-work telephone numbers, and any other personal information that is linked or linkable to an individual.

C.4.E KEY PERSONNEL

The Recipient will provide notice to the AO of any changes in Key Personnel specified in the award. The notice will provide a Resume of the replacement for such Key Personnel. The following person(s) are/have been identified as Key Personnel:

Table C.4.E -- Key Personnel

Names	Title/Position
Michael Finochio	Engineering Manager, City and County of Denver
Crissy Fanganello	Director of Transportation, Public Works

C.4.F PROGRAM INCOME

Pursuant to 2 CFR 200.307, Program income earned during the Agreement period must be added to the Federal award and used for the purposes and under the conditions of the Federal award, unless otherwise approved by the AO. Program income must not be used to offset the Federal or Recipient contribution to this project.

C.4.G SUBAWARDS | SUBCONTRACTS

Unless described in the application and funded in the approved award, the Recipient must obtain prior written approval from the AO for the subaward, transfer, or contracting out of any work under this award. This provision does not apply to the acquisition of supplies, material, equipment, or general support services.The following subawards/subcontracts are currently approved under this Agreement:

Table C.4.G -- Approved Subawardees/Subcontractors

Name
None identified at the time of award

The following subawards/subcontracts consent is withheld under this Agreement:

- All sub-contracts and sub-awards not explicitly identified in Table C.4.G of this section.

Approval of each subaward/subcontract is contingent upon a fair and reasonable price determination, and approval by the AO for each proposed subcontractor/sub-recipient. Consent to enter into subawards/subcontracts will be issued through a formal amendment to the Agreement, or by written notification from the AO.

C.4.H ORDER OF PRECEDENCE

The Recipient's technical and budget applications are accepted, approved, and incorporated herein as Attachment 1 and Attachment 2. In the event of any conflict between this Agreement document and the Recipient's application, this Agreement document shall prevail.

C.4.I DESIGNATION AS RESEARCH OR NON-RESEARCH AGREEMENT

This Agreement is designated as: NON-RESEARCH

C.4.J CONFERENCE SUPPORT RESTRICTIONS

The Recipient must obtain written approval from the AOR prior to incurring any costs for conference or meeting support. See the definition of conference as contained in 2 CFR 200.432.

Food and beverage costs are not allowable conference/meeting expenses for reimbursement under this Agreement.

Note: Costs of meals are allowable as a travel per diem expense for individuals on travel status and pursuant to the Travel clause of this Agreement.

C.4.K TRAVEL

The Recipient may follow their own policies regarding travel, which may be based on actual costs, mileage, and/or per diem, as long as they are reasonable and consistent with travel costs they charge for other activities. If the Recipient does not have written travel policies, then they should follow the Federal Travel Regulations.

The Recipient shall invoice in accordance with 2 CFR §200.474 - Travel costs and the Federal Travel Regulations, and must submit documentation to support all travel costs. Travel requirements under this Agreement shall be met using the most economical form of transportation available. All travel shall be scheduled sufficiently in advance to take advantage of offered discount rates, unless authorized by the Agreement Officer. The following web site provides information on current Per Diem rates:

http://www.gsa.gov/portal/category/100120

C.4.L AGREEMENT PERFORMANCE REQUIREMENTS SUMMARY

Not Applicable.

C.4.M DISPUTES

The parties to this Agreement will communicate with one another in good faith and in a timely and cooperative manner when raising issues under this provision. Any dispute, which for the purposes of this provision includes any disagreement or claim, between the FHWA and the Recipient concerning questions of fact or law arising from or in connection with this Agreement and whether or not involving alleged breach of this Agreement, may be raised only under this Disputes provision.

Whenever a dispute arises, the parties will attempt to resolve the issues involved by discussion and mutual agreement as soon as practical. In no event will a dispute which arose more than three months prior to the notification made under the following paragraph of this provision constitute the basis for relief under this article unless FHWA waives this requirement.

Failing resolution by mutual agreement, the aggrieved party will document the dispute by notifying the other party in writing of the relevant facts, identify unresolved issues and specify the clarification or remedy sought. Within five working days after providing written notice to the other party, the aggrieved party may, in writing, request a decision from one level above the AO. The AO will conduct a review of the matters in dispute and render a decision in writing within thirty calendar days of receipt of such written request. Any decision of the AO is final and binding unless a party will, within thirty calendar days, request further review as provided below.

Upon written request to the FHWA Director, Office of Acquisition and Grants Management or designee, made within thirty calendar days after the AO's written decision or upon unavailability of a decision within the stated time frame under the preceding paragraph, the dispute will be further reviewed. This review will be conducted by the Director, Office of Acquisition and Grants Management. Following the review, the Director, Office of Acquisition and Grants Management, will resolve the issues and notify the parties in writing. Such resolution is not subject to further administrative review and to the extent permitted by law, will be final and binding. Nothing in this Agreement is intended to prevent the parties from pursuing disputes in a United States Federal Court of competent jurisdiction.

C.5 REPORTING

C.5.A ADDRESS FOR SUBMITTAL OF REPORTS AND DOCUMENTS

The Recipient must submit all required reports and documents electronically, under transmittal letter referencing the Agreement number, to the following address(s) follows:

- **Jeffrey Martin**, Agreement Specialist at the following address: **jeffrey.d.martin@dot.gov**
- **Dave Harris,** ATCMTD Program Manager at the following address: **dave.harris@dot.gov**
- **Peter Huang,** Agreement Officer Representative at the following address: **peter.huang@dot.gov**
- **Tricia Sergeson,** Transportation Specialists at the following address: **patricia.sergeson@dot.gov**

C.5.B QUARTERLY PROGRESS REPORT

The Recipient must submit an electronic copy of the SF-PPR to the FHWA staff identified under clause C.5.A on or before the 30th of the month following the calendar quarter being reported. Final PPRs are due 90 days after the end of the Agreement period of performance. The SF-PPR is available online: http://www.whitehouse.gov/sites/default/files/omb/grants/grants_forms.html.

Table 1 -- Quarterly Progress Report Periods

Calendar quarters are defined as:		Reports due on or before:
1st :	January – March	April 30th
2nd:	April – June	July 30th
3rd:	July – September	October 30th
4th:	October – December	January 30th

The quarterly progress report must include the required certification pursuant to 2 CFR 200.415, the SF-PPR cover page and the SF-PPR Block 10 Performance Narrative. The Recipient shall complete the Quarterly Reporting Template, expanding on SF PPR Block 10 as necessary, to include the following information:

a. Work performed for the current quarter;
b. Work planned for the upcoming quarter;
c. Status of all planned procurement activities, proposed procurement schedules, and a list of key procurement milestone dates;
d. Description of any problem encountered or anticipated that will affect the completion of the work within the time and fiscal constraints as set forth in the Agreement, together with recommended solutions to such problems; or, a statement that no problems were encountered;
e. A tabulation, clearly delineated by Federal share, cost share and total, of the current and cumulative costs expended by cost element (labor, travel, indirect costs, sub-recipient/subcontractor, etc.) by quarter versus budgeted costs;
f. Work performed in support of the FHWA and DOT Strategic Goals; and
g. Budget revisions.

In the SF-PPR Block 11, Other Attachments, include the following information as attached pages:

a. SF-425, Federal Financial Report, and
b. SF-425A, Federal Financial Report Attachment (if applicable).

C.5.C ANNUAL BUDGET REVIEW AND PROGRAM PLAN

The Recipient must submit an electronic copy of the Annual Budget Review and Program Plan to the AOR and the Agreement Officer 60 days prior to the anniversary date of this Agreement. The Annual Budget Review and Program Plan must include the required certification pursuant to 2 CFR 200.415. The Annual Budget Review and Program Plan must provide a detailed schedule of activities, estimate of specific performance objectives, include forecasted expenditures, and schedule of milestones for the upcoming year. If there are no proposed deviations from the Approved Project Budget, the Annual Budget Review must contain a statement stating such. The Recipient must meet via teleconference or web conference with the FHWA to discuss the Annual Budget Review and Program Plan. Work proposed under the Annual Budget Review and Program Plan must not commence until AO's written approval is received.

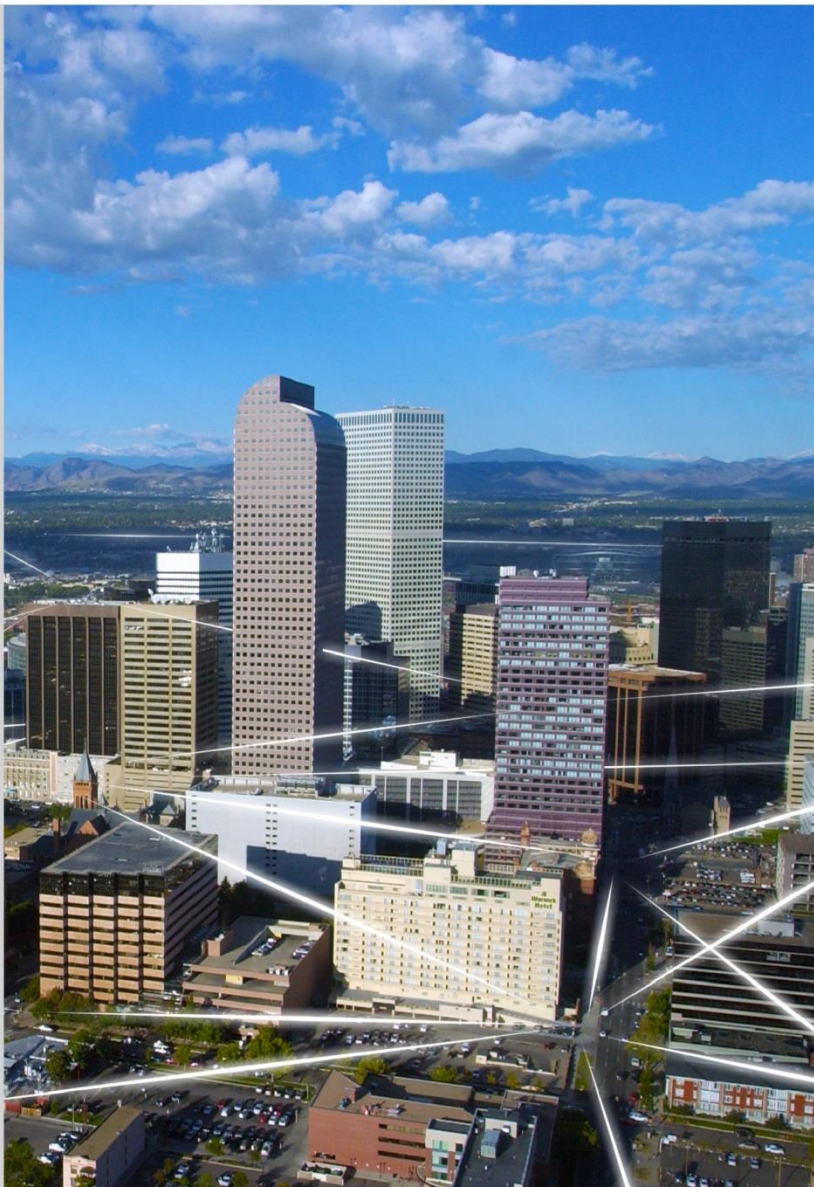
U.S. Department of Transportation
Advanced Transportation Congestion Management Technologies Deployment "ATCMTD" Initiative

DENVER
SMART CITY PROGRAM

ATCMTD
THE CITY AND COUNTY OF DENVER

I. COVER PAGE

Project Name:	**Denver Smart City Program**
Previously Incurred Project Cost:	$200,000
Future Eligible Project Cost:	$0.00
Total Project Cost:	$12,000,014
ATCMTD Request:	$6,000,007
Total Federal Funding (including ATCMTD):	$6,000,007
Are matching funds restricted to a specific project component? If so, which one?	No
State(s) in which the project is located:	Colorado
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	No, the project is not currently programmed into any of the plans listed.



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A. Project Description

1. Introduction

The City and County of Denver is proposing three Intelligent Vehicle (IV) Projects utilizing advanced traveler information systems; advanced transportation management technologies; transportation system performance data collection, analysis, and dissemination systems and advanced safety systems to address issues and challenges in safety, mobility, and sustainability while building a foundation for future projects to improve economic vitality and air quality. Denver, Colorado faces a myriad of challenges at the intersection of transportation, environment and people:

- **Rapid population growth:** 10,000-15,000 new residents move to Denver each year[1],
- **Traffic congestion:** 80 percent of the population commutes in a single-occupant vehicle,
- **Dangerous roadways**: more than 15,000 crashes annually including 129 fatal crashes,
- **High percentage of residents living near or below the poverty rate**: 23.9% of the population is living on less than 125% of the federal poverty level,[2]
- **Increased cost of living**: 30 percent increase in cost of apartment rentals since 2010, and
- **Air pollution**: Denver is an ozone and CO_2 non-attainment area.

Although daunting, Denver's obstacles are not insurmountable. The United States Department of Transportation (USDOT) Smart City Challenge gave Denver the opportunity to develop a comprehensive plan that will address these challenges and transform our region into a global model where transportation and technology can break down barriers and connect all people to mobility freedom and opportunity. The Smart City Challenge served as the seed and spark to identify innovative solutions to our toughest issues. Now, the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Initiative provides the opportunity for the City and County of Denver to bring our most critical Smart City Program projects to life through the proposed IV Projects.

These proposed IV Projects will address and support alleviation of some of our most pressing challenges. In addition to our rapid population growth, Denver has an influx of an additional 200,000 commuters from outside the City traveling to Denver-based jobs during the workweek-with the vast majority driving single occupant vehicles. This creates considerable congestion, yet expanding and widening roads is extraordinarily expensive and traditional infrastructure improvements do not alleviate many of Denver's other challenges. For this reason, we are prepared to match ATCMTD grant funds with City and County of Denver funds to focus first on such proposed IV Projects as the launch of our Smart City Program. These IV Projects will allow us to address our most pressing traffic congestion and safety issues and deliver measurable outcomes aligned with ATCMTD goals and focus areas. Implementing IV Projects will usher in a new era of transformational technologies for Denver and the region, bringing greater mobility safety, efficiency, and reliability to our transportation network. These benefits will also build a foundation for Denver to implement other Smart City projects to reduce costs, connect underserved communities with resources, and bring environmental and economic benefits to the City. The proposed Smart City IV Projects include:

IV-1, Connected Traffic Management Center (TMC) and Connected Fleets. The Denver TMC currently operates and maintains over 1,200 traffic signals, 460 closed circuit TV cameras,

[1] 2015 Census data.
[2] 2014 Census data.

and thousands of sensor and detection devices deployed citywide, but lacks the ability to communicate the valuable information that it gathers regarding roadway closures, construction, dangerous intersections, and other critical traveler information to the public. To meet this need immediately, Denver will partner with Waze (a community-based traffic and navigation application provider) to reduce congestion, improve safety and make data-driven urban planning decisions by connecting our TMC directly with travelers. To innovate today and prepare for the future, we will create a Connected TMC by building a Connected Vehicle (CV) operational environment to support current and future CV applications. As vehicles are a crucial part of a CV future, we will install dedicated short-range communications (DSRC) in 1,500 City fleet vehicles to jumpstart market penetration. The Connected TMC will allow us to innovate today by leveraging our existing ITS infrastructure while simultaneously preparing for a future with increasing CVs. Through IV-1, we aim to reduce crashes at identified Vision Zero intersections by 30% and reduce incident response times for citizen-reported crashes by 30%.

IV-2, Travel Time Reliability as a City Service for Connected Freight. Denver has quickly become a hub for innovation, but it has long been a hub for regional and national freight movement. I-25, I-70, and I-76 are all federally designated high priority corridors that pass through metro Denver, and which converge in North Denver to form a dense freight corridor. However, many of our underserved communities are also located in this corridor and are significantly impacted by noise, pollution, and wandering trucks. Today, freight movement is a free-for-all in North Denver. For years, residents have complained about serious safety issues where trucks are traversing the same neighborhood streets where children walk to school. These issues create a barrier to existing linkages to ladders of opportunities in these areas.

This IV-2 project will transform North Denver into a Freight Efficiency Corridor to tackle these issues. Right now, trucks must travel without much consistent information on traffic or fastest routes to their destination. With DSRC-enabled freight signal priority, we can make the traffic lights work for trucks instead of against them. Denver will be the first in the nation to offer this type of City service to the freight industry if organizations follow new business rules, including avoiding congested freeways, staying out of neighborhoods, and equipping their trucks with DSRC. This improved efficiency will result in long overdue safety improvements for our underserved communities in this corridor. We will target a 20% reduction in freight travel during peak periods to alleviate truck congestion on interstate and state highways, and a 20% reduction in freight travel time on critical arterial routes using freight signal priority. We will also aim to reduce reports of interruptive freight movement in neighborhoods by 30% to increase safety and use of linkages to ladders of opportunity.

IV-3, Safer Pedestrian Crossings for Connected Citizens. There are increasing demands to promote safer walking and biking to improve public health and air quality, as well as to reduce vehicle congestion. In 2015, 1,618 crashes involving pedestrians and 1,147 crashes involving bicycles occurred in Denver. Automated Pedestrian Detection (APD) technologies are a new solution to addressing pedestrian and driver interactions at difficult crossings. This project will deploy APD at four unprotected midblock trail crossings using Rectangular Rapid Flashing Beacons to enhance traditional pedestrian push buttons. Field data from these pilot locations will be continuously sent to the Denver TMC for research, field testing, and fine tuning of the APD system, and will be available to the public. The IV-3 project will also serve as a test for Connected Citizen pedestrian warning systems by allowing us to collect and disseminate pedestrian and bicycle crossing information via DSRC, increasing pedestrian safety.

2. City and County of Denver Travel Characteristics

Denver is a hotbed of innovation and opportunity. The city is experiencing unprecedented growth, increasing from 467,610 people in 1990 to 600,158 in 2010 (28%). The population increased an additional 10% between 2010 and 2014 (see Attachment A for more information regarding Denver's population). Denver also ranked first among big cities for economic and job growth[3] and ranked as the number one "best place for business and careers."[4] This city's work to improve transportation systems was recognized in 2013 when Denver was ranked the overall "Best City for Public Transportation" by U.S. News.[5] However, there is still work to be done in order to continue meeting the growing demands on our transportation network. **Error! Reference source not found.**1 (right) and Figure 2 (below) are infographics which summarize the characteristics and existing infrastructure of Denver to provide insight on the scale and capabilities of our City.

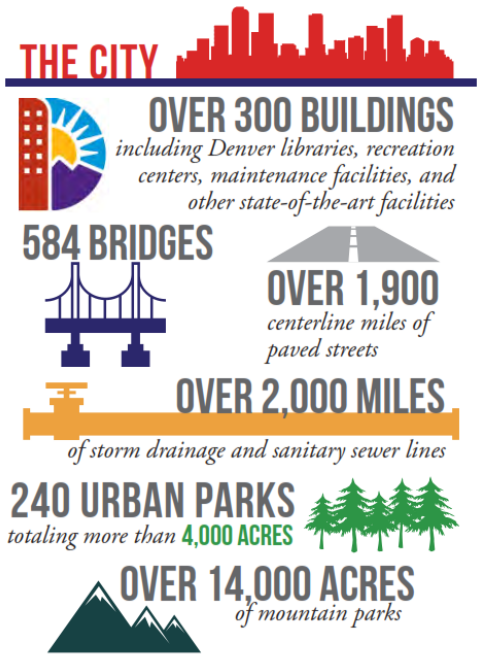


Figure 1. Denver characteristics

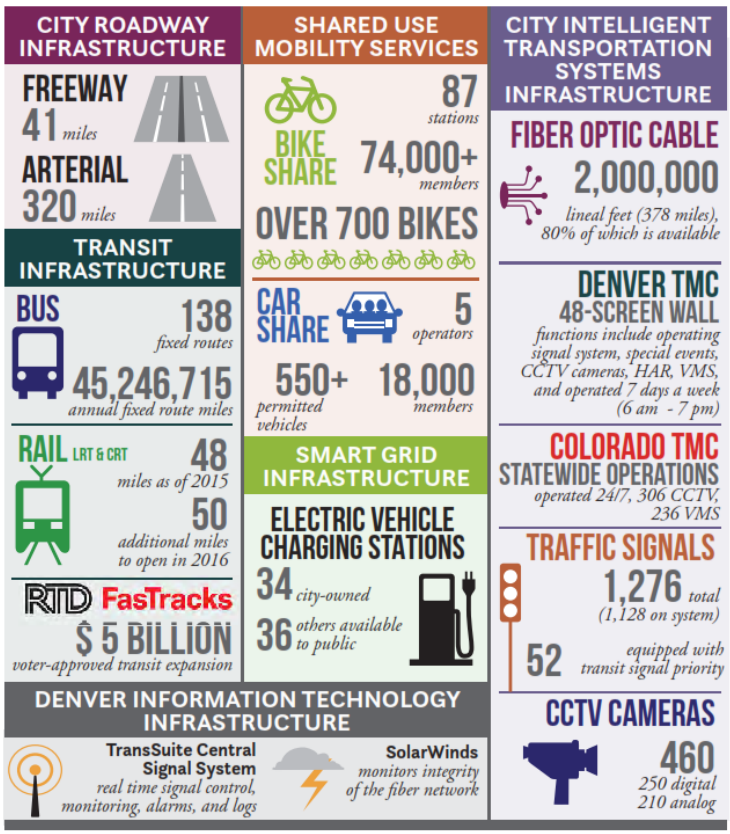


Figure 2. Denver infrastructure

[3]
[4]
[5] USNews, 2013

first responder fleets.

Denver is a city of challenges and opportunities, and therefore perfectly situated to serve as a model for other cities. An ATCMTD investment in Denver is an investment in solutions to challenges facing many cities across the nation. We are one of the most sought after, youngest, fastest growing cities in the nation, yet our infrastructure is extremely strained due to that growth. While we have summer-time ozone issues and localized CO emissions exceedances, we also have a high quality of life that entices many to come to Denver for employment and to live. Similar to other mid-sized cities, our list of challenges is long:

- Changing mobility patterns, particularly for millennials and baby boomers
- Accessibility for underserved populations
- Aging and degraded transportation infrastructure serving an ever-increasing and evolving population
- Technology and cybersecurity demands

Within our Smart City Program, we have prioritized these IV projects because they are focused on addressing these challenges specifically with outcome-based solutions.

a) Partnerships

Denver is fully committed to launching our Smart City Program efforts through partnerships with industry and external entities. We have existing private partners for ongoing Denver programs and initiatives including Panasonic, Xerox, and the Rocky Mountain Institute. They are all committed to helping us to further identify, test, and refine our Smart City Program, vision, and projects. Additionally, we have strong ties with our public sector partners at the Colorado Department of Transportation (CDOT) and the Denver Regional Council of Government (DRCOG) as well other regional neighbors and organizations such as the Metro Chamber of Commerce, and the Metro Mayors Caucus.

A key aspect of our Smart City Program is our SMART Council (described in Section A11, Partnership Plan), which includes strategically selected partners from government, academia, automaker industry, energy, policy, technology, safety, telecom, transportation and professional organizations. We will continue this legacy of partnership and collaboration with our proposed ATCMTD projects. Table 1 below presents each of our key partners for the three proposed IV Projects, including their responsibility and involvement with the projects. Letters of support from some of these partners are included in Attachment B.

Table 1. Denver Smart City Program Partners.

Partners	Responsibility	Projects		
		IV-1	IV-2	IV-3
CDOT	CDOT will bring insights from its $20 million RoadX and CV deployment programs to inform our IV Projects. CDOT is committed to supporting the implementation and acceleration of the Freight Efficiency Corridor Program to help prepare for the $1.2 billion Central I-70 project and to facilitating travel time reliability as a City service via freight signal priority.	X	X	

Partners	Responsibility	Projects		
		IV-1	IV-2	IV-3
DRCOG	DRCOG will participate in the local and regional SMART Council and provide transportation and traffic engineering expertise across all projects.	X	X	X
Jacobs Engineering Group, Inc.	In the role of Program Management Oversight (PMO) and Denver's lead Smart City consultant, Jacobs will draw upon its program management capabilities and leverage its work with CDOT on CV deployment. Jacobs will be responsible for helping Denver ensure the effective execution of the Smart City Program.	X	X	X
Econolite	Denver will partner with Econolite to launch its new CV intersection controller, Cobalt-Sky™. This is the first-ever traffic controller fully designed to apply the robust inputs offered by DSRC. Denver will implement the new traffic controller to enable freight signal priority on project IV-2.		X	X
Peloton Technology	For project IV-2, Peloton Technology will support Denver to launch travel time reliability as a City service to freight fleet operators as an incentive to equip their fleets with DSRC technology.		X	
Waze	The Waze provider Connected Citizens Program will reduce congestion, improve safety and inform smarter urban planning by connecting with travelers through project IV-1.	X		

b) Program Management Approach

Our overall program management approach is based on a lean management structure to ensure we are capable of making timely decisions when they are needed most. We will implement our Smart City Program and the proposed IV projects with the functional systems, organizational constructs, and implementation strategies that ensure we operate in alignment with our values and are achieving Denver's and USDOT's desired outcomes.

The Denver Smart City Program controls and contract administration procedures will track and manage baseline budget control, pending and approved change control, schedule control, monthly progress reports, and all necessary federal funding reports for the IV Projects. Our program management approach is tailored to support the continuous advancement of the entire Smart City Program, and will include management from both the City and the contract program manager.

Denver's Smart City Program will be co-chaired by Crissy Fanganello, the City's Director of Transportation and Mobility, and Evan Dreyer, Mayor Michael Hancock's Deputy Chief of Staff. They will head up an Executive Leadership Committee. The Leadership Committee will include several other key City officials, and also will include representatives from two of our primary Smart City Program collaborators: CDOT and DRCOG. The Executive Leadership Committee will provide strategic guidance and support to our project teams for the proposed IV Projects. The committee will also be responsible for engaging with our SMART Council

(defined in Section 11, Partnership Plan) and other strategic partners.

Project Management Plan. The contract program manager, Jacobs Engineering, will be responsible for monitoring and reporting all elements of Denver's Smart City Program. The proposed program relies on a robust and proven Project Management Plan (PMP) that describes the organization, management control systems, and processes that guide the full range of activities required to implement this groundbreaking program. Jacobs is well versed at successfully managing key PMP processes that will drive this program from initiation, planning and execution to monitoring, controlling and closing. Jacobs will be overseen by key City staff on the IV Project, including the Project Manager and Technical Manager (see Section B1, Staffing Organization). Denver will adhere to Project Management Body of Knowledge, 5th edition standards.

The PMP will be updated on a monthly basis, and will contain scope, schedule, communication, cost, quality, configuration management and risk management plans. Our contract program manager will be fully responsible for ensuring compliance with the PMP throughout the duration of the IV Project's contract. Denver's PMP will:

- Summarize the Smart City Program, including the scope, schedule and capital budget
- Describe organizational, partner and reporting relationships
- Establish goals and objectives that form the basis of the Smart City Program
- Provide information about the organization, control systems, processes, roles, responsibilities and lines of authority within the Smart City Program
- Cite definitive and authoritative references, including specific policies and procedures
- Designate inter-relationships between the Smart City practices and the agency-wide policies and procedures
- Establish consistent management practices
- Form mechanisms for managing technical and financial risks
- Demonstrate that Denver's program is structured in accordance with City and federal requirements

Denver is also committed to IV Project effectiveness, including continually evaluating the need for traditional ITS infrastructure and assessing the possibility of replacing the functionality of those systems with new CV technology. This will allow for continual cost-benefit analyses of planed CV technologies.

Project Funding. The budget estimate for the proposed IV Projects is provided in Section C (Funding Description) and is based on a three-year project period of performance. The estimate includes materials, labor, and installation costs for years one through three as well as an estimate for the annual cost to operate and maintain the proposed systems beyond the proposed grant period, including estimated annual maintenance, utility upgrades, end of useful life replacements, and periodic repairs. IV-1, -2, and -3 project needs will be procured through the City's existing service contracts, and for the purposes of this budget estimate, fully burdened rates have been used. Denver has consulted with third-party vendors, other cities, engineers and contractors installing similar projects to derive the budget costs presented in Section C.

Project Funding for this grant will be managed using Denver's existing PeopleSoft Accounting system to track budgets, encumbrances and payments. A monthly project status report will be created to document the current state of the project. Project tracking, reporting and requests for

reimbursement will be completed in accordance with the Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards.

3. Geographic Areas

We selected the three proposed IV Projects from our Smart City Program due to their focus on solving real safety and congestion challenges that Denver is facing today. A detailed description of each project is provided in Section A5, Transportation Systems and Services. Below is a brief description of the geographic area where each project will be implemented:

IV-1: Connected TMC and Connected Fleets. This project is centered on the Denver TMC, which operates 24 hours per day/seven days per week from within the Webb Municipal Office Building in Downtown Denver. This building houses the City's Transportation and Mobility department, which will implement proposed IV Projects, including IV-1. We will leverage our existing ITS infrastructure and immediately enable the deployment of CV applications by building a CV operational environment at the TMC. We will equip light-duty and heavy-duty City fleet vehicles with DSRC to jumpstart market penetration and empower the CV operational environment. These fleet vehicles blanket the City through daily operations and will generate data throughout Denver, limited to the City and County boundaries.

IV-2: Travel Time Reliability for Connected Freight. This project is focused on addressing the critical safety issues facing Denver's underserved neighborhoods in North Denver, including Globeville, Elyria-Swansea and Montbello. These areas have high percentages of minority populations, households with low-income, and families with children (see Table 2[6] below). These neighborhoods are constantly impacted by trucks traveling through this dense freight corridor, which includes Heartland Expressway, Ports-to-Plains and Camino Real. A Freight Efficiency Corridor will be established in the area bound on the east and west by I-25 and Pena Blvd, respectively (see Attachment C for a map of the Freight Corridor).

Table 2. Characteristics of North Denver Neighborhoods Impacted by Freight Traffic

Characteristic	Globeville	Elyria-Swansea	Montbello	Denver
Percentage of total population that is Hispanic	68%	84%	61%	32%
Percentage of total households with children	43%	55%	72%	25%
Average household income	$39,200	$44,700	N/A	$73,100

IV-3: Safer Pedestrian Crossings for Connected Citizens. This project will pilot APD technologies at the following four locations selected from a recently completed prioritization study of all uncontrolled trail crossings in Denver:

- Weir Gulch Trail at Decatur Street
- Lakewood Gulch Trail at Knox Court
- High Line Canal Trail at Monaco Street
- High Line Canal Trail at Yale Street

These four locations were identified from candidate locations that need additional treatment and

[6] Table Data retrieved from http://denvermetrodata.org/neighborhood/montbello and https://www.denvergov.org/Portals/746/documents/HIA/HIA_Section%202.pdf

were selected based on their proximity to existing traffic signal and communications infrastructure for ease of pilot deployment. By targeting these trail crossings, we expect to increase pedestrian and biker safety. This will also allow us to collect data on pedestrian and biker safety to support implementation of future safety-enhancing projects, encouraging alternative transportation and improving air quality.

4. Real World Issues and Challenges

Foremost among Denver's challenges are rapid population growth and traffic congestion. The city's population has increased by 23% since 2000.[7] This phenomenal residential growth is compounded as each workday 200,000 commuters who live outside of Denver travel to the City for work– the vast majority driving single-occupant vehicles. The traffic congestion created is considerable, as current infrastructure insufficiently supports the high volume of commuters. However, construction to expand and widen roads is extraordinarily expensive. We recently spent $30 million to add one lane for one mile to a major north-south arterial and we are preparing to spend – in partnership with the Federal Highway Administration and CDOT – $1.2 billion to add lanes to Interstate 70 and reconnect the urban street grid northeast of downtown. These are important improvements, but they are built on a supply model that we cannot sustain financially and do not utilize available technology or improve resident outcomes.

Traditional infrastructure improvements also do not alleviate many of Denver's other challenges, such as our difficulties obtaining compliance with federal ozone standards due to traffic congestion or high incidents of traffic accidents. Each year Denver has 15,000 crashes, with 129 resulting in fatality. In 2015 alone, Denver had 1,147 crashes involving bicycles and 1,618 crashes involving pedestrians.

Additionally, Denver has increasing cost of living, underserved areas, and children living in poverty. Since 2010, Denver rent prices have increased more than 5% each year,[8] making it harder for low-income families to remain or relocate here, and all but impossible for low-wage workers to live close to their jobs. Perhaps most alarming – up to 40% of Denver's residents live in underserved neighborhoods, primarily in the western, northern and northeastern portions of the city. Many of these underserved neighborhoods are disconnected by physical barriers such as highways, railroads and rivers, creating food deserts that negatively impact health.[9] These underserved communities have disproportionately high minority populations (see Table 2 above). Also, nearly one of every four Denver children lives in an area of concentrated poverty. The number of homeless students in Denver has increased 41% since 2013-14 and has doubled across the entire metro area since 2008.[10]

While all of these issues are not part of the measureable outcomes of this project, by implementing IV projects 1-3 we hope to lessen the impacts of these difficulties on the city and provide foundational technologies and data sources to further lessen these challenges with other Smart City projects. By targeting freight issues in underserved communities, IV-2 will increase

[7] 2015 Census data.

[8] FOX 31 Denver (2015). Study: Denver apartment rent increases to be the largest this year. Retrieved from http://kdvr.com/2015/04/14/study-denver-apartment-rent-increases-to-be-largest-in-u-s-this-year/

[9] Moyer, D. C. (2013). Denver food deserts and the impact on health. University of Denver. Retrieved from http://www.du.edu/korbel/ipps/media/documents/moyer_policymemo.pdf

[10] Denver Office of Children's Affairs (2015). The status of Denver's children: Community resource. Retrieved from https://www.denvergov.org/content/dam/denvergov/Portals/713/documents/2014_Data--Lisa/Status%20of%20Denver's%20Children%202015%20A%20Community%20Resource.pdf

the safety of residents and eliminate barriers to their utilization of linkages to ladders of opportunity, allowing residents safe passage to work or school. We anticipate this will also decrease the number of pedestrian-auto crashes and traffic accidents and fatalities by reducing interruptive freight movement in these neighborhood communities. IV-3 will also increase pedestrian safety through crossing technologies, ultimately reduce pedestrian-auto crashes and encourage walking or biking. This improves resident health, use of linkages to opportunity, and air quality. This is especially important for low-income communities that may have fewer transportation options and less access to opportunities. Additionally, by implementing CV technologies, we anticipate reduction of traffic accidents and fatalities through use of real-time data for reducing incident response times, as well as injuries and crashes at identified Vision Zero intersections.

Alignment with ATCMTD Goals and Focus Areas

The IV Projects proposed for our Denver Smart City Program will deploy technologies targeted by the ATCMTD initiative including 1) advanced traveler information systems, 2) advanced transportation management technologies, and 3) advanced safety systems including V2V and V2I communications, technologies associated with autonomous vehicles, and other collision avoidance technologies, including systems using cellular technology. Table 3 below presents where projects IV-1 through IV-3 align with the ATCMTD initiative's focus areas, while Table 4 describes how each project aligns with ATCMTD goals.

Table 3. Proposed Project Alignment with ATCMTD Focus Areas

		Projects		
Relevant ATCMTD Focus Areas	**Alignment with IV Projects**	**IV-1**	**IV-2**	**IV-3**
Transportation elements associated with Smart Cities	All 3 IV projects will deploy Smart Cities technology focused on improving transportation, including improving connectivity for the Denver TMC (IV-1), implementing DSRC to enable freight signal priority (IV-2) and deploying APD technology to make pedestrian crossings safer (IV-3).	X	X	X
Systemic applied pedestrian crossing technology	IV-3 will deploy APD technology at locations selected based on roadway characteristics including number of lanes and speed limits, population density, proximity to retail and crash history.			X
Traffic signal data acquisition, analysis, and management	All three IV projects involve capturing traffic signal data at the Denver TMC in order to better manage and analyze Denver roadways for improved traffic operations throughout the city. This includes creating a CV operational environment to capture traffic signal data (IV-1), deploying a freight signal priority application using traffic signal data (IV-2) and implementing APD technology integrated with traffic signal data (IV-3).	X	X	X
Incorporation of connected vehicle (CV) technology in	IV-1 will deploy DSRC in 1,500 heavy duty and light duty City vehicles.	X		

public sector and first responder fleets				

Table 4. Proposed Project Alignment with ATCMTD Goals and Focus Areas

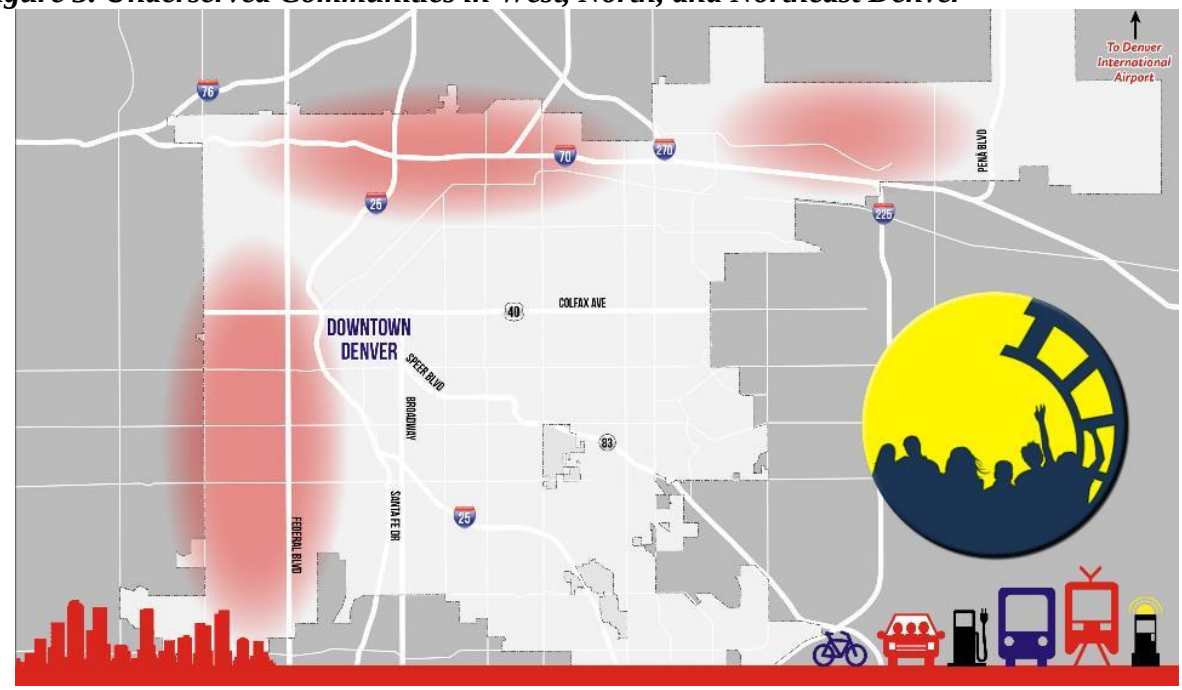
		Projects		
ATCMTD Goals	**Alignment with IV Projects**	**IV -1**	**IV -2**	**IV -3**
Reduced costs and improved return on investments, including through the enhanced use of existing transportation capacity	By enabling the Denver TMC to use connected vehicle technology as an emerging data source, IV-1 will allow Denver to continuously assess the need to invest in expensive traditional ITS infrastructure, opening the door for reduced costs and improved return on investment. IV-2 will improve the efficiency of freight movement in North Denver to better leverage the existing transportation capacity of the highways and arterials that serve this dense freight corridor.	X	X	
Delivery of environmental benefits that alleviate congestion and streamline traffic flow	By providing better traveler information to the public (IV-1) and delivering travel time reliability as a City service (IV-2), Denver will improve safety and reduce congestion on its roadways citywide, which will have compounding benefits on the environment and on traffic flow.	X	X	
Measurement and improvement of the operational performance of the applicable transportation networks	By building a CV operational environment at the Denver TMC (IV-1) and deploying DSRC technology in the North Denver freight corridor (IV-2), we will gain the ability to constantly measure and improve operational performance of our transportation networks citywide.	X	X	
Reduction in the number and severity of traffic crashes and an increase in driver, passenger, and pedestrian safety	All three IV projects are targeting transformational benefits in safety. IV-1 will deliver Vision Zero messaging with Waze to warn drivers of dangerous intersections, IV-2 will keep trucks off of neighborhood streets, and IV-3 will deploy APD technology to improve pedestrian and bicycle safety.	X	X	X
Collection, dissemination, and use of real time transportation related information to improve mobility, reduce congestion, and provide for more efficient and accessible transportation, including access to safe, reliable, and affordable connections to employment, education, healthcare, freight facilities, and other services	All three IV projects will collect, disseminate, and use real-time data to achieve system performance improvements and transformational safety, mobility, and environmental benefits. IV-1 will empower the Denver TMC to utilize CV data. IV-2 will use DSRC data to deliver travel time reliability as a City service. IV-3 will deploy APD technology that will serve as an entirely new data source to improve and continuously evaluate conflicts at crossings for pedestrians and bicyclists.	X	X	X

		Projects		
ATCMTD Goals	**Alignment with IV Projects**	**IV -1**	**IV -2**	**IV -3**
Delivery of economic benefits by reducing delays, improving system performance and throughput, and providing for the efficient and reliable movement of people, goods, and services	IV-2 will specifically target the freight industry to reduce delays and improve the performance of the transportation network and movement of goods in North Denver by providing travel time reliability as a City service.		X	
Accelerated deployment of vehicle-to-vehicle, vehicle-to-infrastructure, and automated vehicle applications, and autonomous vehicles and other advanced technologies	All three IV projects are focused on deploying connected vehicle technology. IV-1 will build the foundational CV operational environment necessary to deliver the DSRC freight signal priority application for IV-2 and deploy the Connected Citizen test bed for IV-3.	X	X	X
Integration of advanced technologies into transportation system management and operations	The applications deployed for each project will be integrated into the daily operations of our transportation system and network through building a CV operational environment for the Denver TMC (IV-1).	X		
Demonstration, quantification, and evaluation of the impact of these advanced technologies, strategies, and applications toward improved safety, efficiency, and sustainable movement of people and goods	By building a CV operational environment at the Denver TMC (IV-1), deploying DSRC technology in the North Denver freight corridor (IV-2), and deploying innovative APD technology (IV-3), we will demonstrate advanced technologies and gain the ability to quantify and evaluate the impact and benefits of these deployments.	X	X	X
Reproducibility of successful systems and services for technology and knowledge transfer to other locations facing similar challenges	All three of the IV projects are designed to serve as a model for other cities so that the technology and approach are both replicable and transferable around the nation.	X	X	X

Linkages to Ladders of Opportunity

We have a vision for our transportation future in Denver – A city where transportation and technology break down barriers and connect *all* people to mobility freedom and opportunity. All of our Smart City Program projects are targeted toward the areas of greatest need: West, North, and Northeast Denver, including the neighborhoods of Sun Valley, Globeville, Elyria-Swansea, and Montbello. Figure 3 (below) shows the geographic areas for our underserved communities. Specifically, Intelligent Vehicle project IV-2 will bring long overdue safety improvements for our underserved communities in North Denver by decreasing freight traffic in the Globeville, Elyria-Swansea and Montbello neighborhoods. While these neighborhoods have linkages to ladders of opportunity, those opportunities are being blocked by safety and congestion issues. Improved efficiency for freight movement in North Denver means less congestion, pollution, and noise in the neighborhoods most impacted by the industry. This will allow residents of these underserved communities to utilize their existing linkages to ladders of opportunity.

Figure 3. Underserved Communities in West, North, and Northeast Denver



5. Transportation Systems and Services

Automated Vehicle (AV) technology continues to advance at a rapid pace. Transformational benefits are on the near horizon and will bring greater safety, efficiency and access to transportation for residents, commuters and tourists – especially the young, elderly, disabled and underserved. Our Smart City Program will advance automation by funding projects that prepare our residents, our infrastructure and Colorado's regulatory environment for this technological revolution.

We recognize connectivity as a critical first step in ensuring a safe and coordinated environment for AVs. CV technology enables a transportation network to operate as an integrated system with Vehicle-to-Vehicle (V2V), Vehicle to Infrastructure (V2I) communication, and Vehicle-to-Device (V2X) communication. Many aspects of CV technology are ready for adoption today and offer significant opportunities to improve safety, mobility, and environmental impact. Denver is committed to realizing CV implementation with three key IV Projects to solve real safety and

congestion challenges that we are facing today and need to solve. We are building a future in connected automation to systematically align the needs of users and businesses with the transportation network for a safer, smarter and more environmentally friendly Denver. Below we present the proposed transportation systems and services for each of these projects.

IV-1, Connected TMC and Connected Fleets. TMC has significant infrastructure in place that will be leveraged for IV-1, including the 1,200 traffic signals, 460 closed circuit TV cameras and thousands of sensor and detection devices it operates and maintains. TMC operators monitor roadway conditions, special events and incidents seven days per week. The Denver TMC also shares data with CDOT's TMC. With a vast amount of data and ITS capability, Denver TMC operators often have valuable insight into the impacts of traffic, roadway construction and incidents – but they have limited ability to share that information with the traveling public. Our Smart City Program will develop a CV architecture and build an operational environment at the Denver TMC to reduce congestion and improve safety by connecting directly with travelers. We will immediately empower the CV environment by delivering DSRC applications for freight efficiency and by creating a live testing system for our most congested corridors – preparing Denver to be the first city that actively uses DSRC data for traffic signal control.

Waze Connected Citizens Program for Safety and Mobility. Denver is home to an estimated 150,000 active Waze users who report nearly 240,000 alerts while driving 25 million miles per month. They provide valuable insight into roadway conditions and incidents. By establishing a two-way data exchange between Waze and the Denver TMC at zero cost to our program, we will: 1) gain greater insight into roadway conditions with real-time incident and traffic jam information; 2) reduce traffic congestion with improved traveler information to reroute users around road closures, construction and incidents in real-time; 3) implement a Vision Zero messaging campaign to improve safety at our most dangerous intersections; 4) improve incident response times; and 5) make data-driven infrastructure decisions for smarter urban planning.

Denver TMC CV Operational Environment. As Denver adopts CV technology, we will establish the organizing principles and fundamental building blocks of a CV operational environment for the TMC. To utilize the expansive new data enabled by CV technology, it will be essential that the TMC be capable of collecting, parsing, storing, mining and analyzing CV data. Using the Connected Vehicle Reference Implementation Architecture as a guide, we will partner with CDOT and DRCOG to update the ITS Architecture for the Denver Regional Area and to ensure regional and national transferability of the architecture.

The CV architecture will support all physical components of a CV operational environment including existing ITS infrastructure, DSRC roadside equipment, vehicle-based DSRC devices, and other CV traveler equipment including portable DSRC, smartphones, tablets and satellite-based systems. We will deliver the computing, storage, privacy, security and data access capabilities necessary to develop center-based data management systems and connections to support services, including the USDOT Security Credential Management System, for our CV environment. We will design, build and test the Denver TMC CV operational environment as a foundation for a future with increasing CV data and to support our Smart City CV applications immediately. Attachment D is a context diagram showing how the Denver TMC CV operational environment will be delivered in parallel and work in harmony with our existing ITS and traffic management infrastructure.

Connected Fleets. City fleet vehicles blanket the city through daily operations. Equipped

vehicles are essential to the design, testing and operation of the Denver TMC CV operational environment. We will equip our fleet of 1,500 light- and heavy-duty vehicles with DSRC to lead by example and immediately generate Basic Safety Messages as vehicles move throughout the city. We will install DSRC roadside units at the three primary City facilities to facilitate capturing, processing, and analyzing the BSM data generated by fleet vehicles. We will launch a DSRC Equip Program to equip an additional 1,500 vehicles for citizens and partner fleets.

Tasks. We will complete the following tasks to successfully deliver project IV-1:

- **Task 1:** Develop project plan
- **Task 2:** Collaborate with Waze Connected Citizens Program to enhance traveler information
- **Task 3:** Design, build and test the Denver TMC CV environment
- **Task 4:** Equip the City fleet with DSRC
- **Task 5:** Design and launch DSRC Equip Program for other fleets and individual consumers

IV-2, Travel Time Reliability for Connected Freight. Colorado is home to three federally designated high priority corridors – Heartland Expressway, Ports-to-Plains and Camino Real – that pass directly through metro Denver (map of freight corridor included as Attachment C). Freight movement is closely connected to the health of our economy and the transportation system in our state. The Colorado Freight System includes highways, rail lines, airports and other intermodal facilities. It delivers goods, creates jobs and provides economic opportunities to people statewide. The transportation and warehousing sector in Colorado contributes $79 billion to Colorado's economy each year[11].

Given that a great majority of the region's population and traffic growth is expected to occur within I-25's north-south and I-70's east-west corridors, and that significant highway expansion is not likely, congestion will continue to be a challenge for freight movement. The Denver neighborhoods and local roads near major freight facilities and distribution centers are significantly impacted by freight traffic, noise and pollution. ***We have received complaints for decades about serious safety issues where trucks are traveling the same neighborhood streets where children walk to school.*** As plans proceed for the federally funded $1.2 billion reconstruction of I-70, underserved communities such as Globeville, Elyria-Swansea and Montbello stand to face even greater impacts during the extended construction than they already experience.

CV technology presents a wealth of capabilities to address these challenges. Denver will implement a Freight Efficiency Corridor Program and provide travel time reliability northeast of downtown in partnership with CDOT, Peloton Technology and Econolite.

Freight Efficiency Program. Denver will convene a broad stakeholder group to serve as the Freight Efficiency Corridor Program's Project Leadership Team (PLT). The PLT will consist of representatives from key equity partners to represent underserved communities. Other team members will include representatives from CDOT's Freight Advisory Committee, Colorado Motor Carrier Association, Metro Denver Chamber of Commerce, Metro Denver Economic Development Corp., Peloton Technology, UPS, FedEx, Safeway, and Walmart. The program will provide: 1) designated parking and staging areas for freight movement into the Denver area; 2) regularly updated and comprehensively defined routes for all freight traffic, not just oversize or hazardous movements; and 3) enhanced data collection capabilities to understand, assess and

[11] CDOT (2015). State highway freight plan.

respond to freight movement through Denver communities.

Travel Time Reliability as a Service Using Freight Signal Priority. Denver will be the first in the nation to deliver travel time reliability as a service to the freight industry using traffic signal priority. This has three major benefits, as it 1) incentivizes fleets to equip with DSRC at their expense, 2) gives Denver the opportunity to drive business rules for freight travel through the City in order to reduce peak period traffic and lessen the impact on underserved communities, providing proactive instead of reactive guidance to the freight industry, and 3) coincides perfectly with upcoming I-70 reconstruction, which will require extensive freight industry engagement. We will use technology to provide a service and help the industry navigate the construction impact instead of merely offering information about the impact.

To deliver this service, we will:

- Equip designated arterials and freeways with 100 DSRC Road Side Units
- Design, test, deploy and evaluate a DSRC-based freight signal priority application in partnership with Econolite
- Launch travel time reliability as a City service to freight fleet operators as an incentive to equip their fleets with DSRC technology facilitated by Peloton Technology
- Demonstrate a first-in-the-nation arterial freight platooning operation with signal priority using Peloton and Econolite technology to exhibit future possibilities

Providing a travel time reliability service to the freight industry will not only reduce the high cost and environmental impact of freight congestion but it will significantly improve the quality of life in the neighborhoods and underserved communities that surround many of Denver's high throughput freight facilities and distribution centers.

Tasks. We will complete the following tasks to successfully deliver project IV-2:

- **Task 1:** Develop project plan
- **Task 2:** Engage stakeholders and develop a Freight Efficiency Corridor Program
- **Task 3:** Design and launch Freight Efficiency Corridor Program
- **Task 4:** Design, develop, test and deploy freight signal priority on arterials
- **Task 5:** Coordinate outreach and communication to freight industry via Peloton Technology
- **Task 6:** Launch Denver travel time reliability service for connected freight
- **Task 7:** Evaluate Denver travel time reliability service for connected freight
- **Task 8:** Design, develop, test and demonstrate arterial freight platooning operation using freight signal priority

IV-3, Safer Pedestrian Crossing for Connected Citizens. Federally assisted pilot programs for Automated Pedestrian Detection (APD) are needed in the United States in order to collect and evaluate pedestrian and driver interaction with technologies like Rectangular Rapid Flashing Beacons (RRFB) and Hawk Signals installations. There are increasing demands on public agencies to promote safer walking and biking to improve public health, improve air quality, and to reduce vehicle congestion. The ATCMTD grant provides the opportunity to deploy APD at unprotected midblock trail crossings in conjunction with RRFB. This pilot project will install APD devices to enhance traditional pedestrian push buttons at four unprotected midblock trail crossings, including Weir Gulch Trail at Decatur Street, Lakewood Gulch Trail at Knox Court, High Line Canal Trail at Monaco Street and High Line Canal Trail at Yale Street.

The initial pilot project will be used to place pedestrian, or bicycle calls in lieu of pedestrian push

buttons. It will also be used to extend flashing beacon times for late arriving and slower than average pedestrians. It is anticipated that installing APD in conjunction with RRFBs will assist bicycles and mobility impaired people who cannot always reach or find the pedestrian push buttons. Field data from these locations will be continuously sent to Denver's Traffic Management Center (TMC) for public access, research, field testing, and fine tuning of the APD system. Findings from this pilot will also be used for APD implementation at Hawk Signals, and traditional signalized intersections. This project will also serve as a test bed for Connected Citizen pedestrian warning systems by collecting and disseminating pedestrian and bicycle crossing information via DSRC.

Tasks. We will complete the following tasks to successfully deliver project IV-3:

- **Task 1:** Develop project plan
- **Task 2:** Develop, test, and deploy APD at four selected pilot locations
- **Task 3:** Develop, test, and deploy Denver TMC connection to APD field devices
- **Task 4:** Evaluate APD implementation
- **Task 5:** Develop, test, and deploy DSRC at APD locations to collect and disseminate pedestrian and bicycle crossing information

6. Long-Term Operations and Maintenance

The USDOT Smart City Challenge, along with all of our ongoing Smart City efforts, has been prioritized to ensure we meet the current and future expectations of our customers in the community. This prioritization is evident in our ongoing budgeting processes for a variety of resources including staffing, materials, and evaluation. Our commitment will stand strong as we continue to set goals and drive toward a variety of outcomes, many of which will only be achieved outside of the proposed three year ATCMTD grant period of performance. Denver is and intends to continue to be transparent in our priorities and funding for innovative, entrepreneurial, and technological approaches to achieve affordable, safe, reliable transportation outcomes and mobility freedom for all members of our community. We believe our commitment to transparency with our community necessitates accountability with our staff and elected/community leaders.

In our budget estimate, we have provided the expected continued annual investment necessary beyond the three-year period of performance (see Attachment E). We will ensure long-term operations and maintenance of the proposed systems by programming this into our annual budget process. The long-term operations and maintenance activities that will be programmed include annual maintenance, utility upgrades, end of useful life replacements, and periodic repairs.

7. Challenges to Deployment

The key challenges related to our Smart City Program are presented in the graphic below as technical, policy, and institutional project risks along with a proposed mitigation strategy and estimated level of impact.

Figure 4. Anticipated Challenges and Mitigation Strategies

Risk Category	Risk	Mitigation Strategy	Impact
Technical	Addressing system security and data privacy	Prioritize security and privacy using national and regional standards to guide the design of the Enterprise Data Management platform and ensure all data in and data out of the Smart City system is properly managed.	High
	Managing the complexity of a Smart City system	Establish an experienced team of systems engineers prepared to handle the multilayered task of integrating multiple system inputs for a large, complex deployment.	Medium
	Prioritizing Smart City solutions	Build a cross-discipline stakeholder group representative of the users of the system.	Medium
	Addressing data quality and integrity issues	Avoid the "trash-in, trash-out" problem by establishing data quality standards and checking data quality before, during, and after implementation.	Medium
	Matching the pace and availability of emerging technology	Institute a user-needs approach to implementing technology. Allow the needs and availability of technology to drive the solutions rather than select and implement a technology without a defined goal.	Low
Policy	USDOT drops commitment to Smart City implementation	Leverage other federal funds and seek additional local resources to implement as many of the Smart City Program elements as possible.	Low
Institutional	Cost overruns/scope creep	Develop and implement a meaningful and actionable Program Management Plan to help control costs and ensure minimal scope creep while continuing to allow for changes to the Program that maintain alignment with the grant's goals.	Medium
	Lack of (or reductions in) stakeholder support	Reinforce stakeholder support prior to project kick-off and maintain positive working relationships and open communication with all stakeholders.	Medium
	Inability to reach agreement among project partners	Reinforce agreements with project partners prior to beginning of Program, and require adherence to the Program Management Plan throughout the life of the project.	Low
	Lacking financial sustainability to continue program	Ensure partners' long term commitment to Program components and institutionalize those elements moving forward.	Low

8. System Performance Improvements

Performance measurement is strongly embedded in Denver's culture and provides significant value to Denver. For the last four years, Peak Performance, Peak Academy and Peak Analytics have established a performance framework throughout the entire City enterprise to actively manage, innovate and improve delivery of services. The simple framework requires agencies to establish a strategic plan, develop performance measures, create a cadence of accountability and participate in training and receive coaching on improving service delivery.

Each agency meets regularly with the Mayor, Budget Director, Chief Performance Officer and others to review key performance indicators and discuss innovations and challenges within the agency. Peak Academy works with every agency's front line staff on problem solving, process improvement and innovation. Since the inception of Peak, this nationally recognized program has trained more than 5,000 employees and resulted in $15 million worth of hard and soft

savings to the City and additional value created for citizens. In the second half of 2016, Peak will conduct multiagency report-outs on coordinated efforts to achieve the City's 2020 Sustainability Goals.

Following Peak standard practices in problem definition, Denver will begin a Performance Measurement Plan for our Smart City Program by creating a logic model for each IV project. Using stakeholder input, these models will outline the project scope and enumerate all relevant inputs, outputs, key short- or long-term outcomes and metrics that will be used to quantify performance. The plan will also detail major assumptions, including identification of external factors that could impact results, and will create an actionable plan to achieve outcomes.

With this approach, Denver will target measurable outcomes for the three proposed Smart City Program projects, IV-1 through IV-3 (see Table 5 below), which are expected to be nearly or completely met by the first year after project implementation. While IV-1 and IV-2 are anticipated to create significant performance improvements, IV-3 is not anticipated to improve system performance, due to its focus on safety and the pilot nature of the project.

Table 5. System Performance Improvements

Smart City Program Project	System Performance Improvements
IV-1: Connected Traffic Management Center and Connected Fleets	• Reduce incident response times for citizen-reported crashes by 30% • Increase DSRC vehicle market penetration to 10% by 2020
IV-2: Travel Time Reliability for Connected Freight	• Reduce travel time on designated arterial routes by 20% using freight signal priority • Reduce reports of interruptive freight movement in neighborhood communities by 30% • Reduce freight traffic on major freeways and arterials in the Freight Efficiency Corridor by 20% during peak periods

9. Safety, Mobility, and Environment Benefits

In addition to the system performance improvements identified above, Denver will target the following safety, mobility, and environmental benefits for the three proposed Smart City Program projects, IV-1 through IV-3 (see Table 6). These benefits are expected to be realized by the first year after project implementation.

Table 6. Safety, Mobility and Environmental Benefits

Smart City Program Project	Safety, Mobility, and Environmental Benefits
IV-1: Connected Traffic Management Center and Connected Fleets	• Reduce injuries at identified Vision Zero intersections by 30% • Reduce crashes at identified Vision Zero intersections by 30% • Analyze the 240,000 monthly Waze user reports for traffic flow and incident patterns • Reduce incident response times for citizen-reported crashes by 30%

Smart City Program Project	Safety, Mobility, and Environmental Benefits
IV-2: Travel Time Reliability for Connected Freight	• Reduce travel time on designated arterial routes by 20% using freight signal priority • Reduce reports of interruptive freight movement in neighborhood communities by 30% • Reduce freight traffic on major freeways and arterials in the Freight Efficiency Corridor by 20% during peak periods • Reduce spot measurement of emissions at heavy freight movement intersections by 50% for platooning demonstration • Increase throughput at intersections by a factor of two to three times for platooning demonstration
IV-3: Safer Pedestrian Crossings for Connected Citizens	• Reduce conflicts and near-misses at uncontrolled trail crossing pilot locations • Provide safer walking and biking opportunities to improve public health, reduce vehicle congestion, and improve air quality

Benefit projections for IV-3 are unable to be quantified at this time due to lack of baseline data on conflicts and near misses at trail crossings. Implementing IV-3 will allow us to track and measure this data to quantify these conflicts moving forward.

10. Vision, Goals and Objectives for the Deployment

Goal setting, continuous improvement and performance measurement are fundamental to Denver's entire business practice. For example, we set goals for sustainability and measure against them in every possible category, including air quality, climate, housing, mobility and workforce. Four years ago we launched Peak Performance, a citywide improvement program designed to transform Denver into a data-driven government. Our vision for our Smart City Program is to "create a city where transportation and technology break down barriers and connect all people to mobility freedom and opportunity." We have identified three (3) overarching goals which are all relevant to the proposed IV projects. Table 7 (below) presents each goal and its relevant impact area and component. For Goal 1, we present our detailed objectives, targeted measurable outcomes (see Table 7). As Goals 2 and 3 are broad reaching, they do not have specific measurable outcomes.

Table 7. IV Project Goals, Objectives, and Measurable Outcomes

Goal #1: Improve Connectivity Impact Area(s) – Ladders of Opportunity, Mobility, and Safety	
Objectives	**Measurable Outcomes**
1. Build a connected vehicle operational environment at the Denver Traffic Management Center	• Reduce injuries at identified Vision Zero intersections by 30% • Reduce crashes at identified Vision Zero intersections by 30% • Analyze 240,000 monthly Waze user reports for traffic flow and incident patterns • Reduce incident response times for citizen-reported crashes by 30%

Goal #1: Improve Connectivity Impact Area(s) – Ladders of Opportunity, Mobility, and Safety	
Objectives	**Measurable Outcomes**
2. Equip 3,000 vehicles with dedicated short range communication (DSRC) to jumpstart market penetration	• Increase DSRC vehicle market penetration to 10 percent by 2020
3. Offer travel time reliability service to freight industry using DSRC-based traffic signal priority	• Reduce travel time on designated arterial routes by 20% using freight signal priority • Reduce reports for interruptive freight movement in neighborhood communities by 30% • Reduce freight traffic on major freeways and arterials in the Freight Efficiency Corridor by 20% during peak periods • Reduce spot measurement of emissions at heavy freight movement intersections by 50% for platooning demonstration • Increase throughput at intersections by a factor of two or three times for platooning demonstration
Goal #2: Leverage Partners Impact Area(s) – Efficiency	
Objectives	
1. Leverage CDOT's $20 million RoadX Program and their additional $7M contribution to bolster our projects focused on freight efficiency and integrated freeway and arterial operations (IV).	
2. Deploy the first implementation of Econolite's new Connected Vehicle intersection controller, Cobalt Sky™ (IV).	
Goal #3: Collaborate at Every Level Impact Area(s) – Efficiency	
Objectives	
1. Unite cities around the nation with local, national and international experts through our SMART Council.	
2. Deliver technology-driven solutions designed by and for our communities that are measurable, scalable, replicable and exportable to cities nationwide.	
3. Collaborate with and provide open access to USDOT's independent evaluation team to monitor our progress toward our goals, objectives, and measurable outcomes.	
4. Publish our Smart City Program performance metrics to visualize progress toward our goals and objectives.	

11. Partnership Plan

Denver recognizes that cities need to move beyond fragmented or incremental thinking in today's fast-paced global economy, especially when it comes to instituting new technologies. Cities must build and continuously renew networks of collaborators and partners. To engage in and utilize partnerships for the Denver Smart City Program, we will create a Start-ups, Municipalities and Academic Research for Technology (SMART) Council.

SMART Council

Denver's SMART Council will lead and inform our program and provide us with a vehicle for sharing, replicating and exporting results. The SMART Council will unite the City with start-ups, tech innovators, municipalities across the nation and the world, academic researchers, and transportation service providers. The SMART Council will be essential to successfully delivering the proposed Intelligent Vehicle projects for the ATCMTD grant opportunity and will serve as our strategy and plan for ensuring successful partner engagement through the period of performance. The Council will be organized into four sub groups under our Smart City Program that will meet quarterly and report to the Smart City Executive Team:

1. Local SMART Council Work Group. At the local level, Denver will establish a community-based SMART Council Work Group. Mobility users, neighborhood residents, stakeholder organizations and nonprofit providers such as Mile High United Way and Mile High Connects (a cross-sector partnership of organizations committed to increasing access to housing) will provide key input into our program. We also will engage foundations, neighboring municipalities, and organizations such as RTD, DRCOG and the Metro Mayors Caucus. This local SMART Council Work Group will meet at least quarterly to ensure stakeholder input is central to the projects.

2. National/International Cities SMART Council. The reach of the SMART Council will go far beyond our local borders. We will invite the six other Smart City Challenge finalist cities to join the national and international arm of the SMART Council, as well as other national and global cities. This concept has already received support from 20 cities, including Atlanta, Indianapolis, Baltimore and Seattle. Denver will partner with Transportation for America and utilize its already established network of partner cities and organizations to ensure that we share our successes and challenges with a dedicated group of communities. This group will serve as an assembly of ideas, where concepts will be shared during an annual global summit, regular face-to-face meetings, online webinars and on our Smart City website. This will be the forum for the brightest minds from around the country and the globe to help us refine our projects and prepare them for scaling and exporting.

3. Start-Up/Entrepreneurial Community – SMART Council Spark. Denver has cultivated powerful partnerships with the Colorado Technology Association, local tech incubators Galvanize and Innovation Pavilion, and national organizations such as 1776. These and other engines of innovation and new ideas will serve on the SMART Council's Spark Committee to infuse new energy into our thinking and project applications.

4. Research and Education – Academic SMART. Academic SMART Council, co-led by Colorado State University and the University of Colorado Denver, will bring an important research component to our Smart City Program. Other coalition members will include Colorado School of Mines, North Dakota State University, Mountain Plains Consortium University Transportation Center, Virginia Tech Transportation Institute and University of California Riverside. The National Renewable Energy Laboratory and Electric Power Research Institute will also contribute to this subset of the SMART Council.

This research arm of the SMART Council will bring together multidisciplinary teams of researchers, educators, policymakers and stakeholders to conduct collaborative research that addresses the fundamental challenges of implementing Smart City technologies and informs decisions that lead to energy, economic, environmental, social and cultural sustainability. Understanding these challenges and the underlying impacts of smart city technologies is a vital

component of replicable strategies.

The Academic SMART Council will also focus on education and workforce development to help develop the next generation of Smart City professionals, particularly women and underrepresented minorities in STEM fields. The committee will oversee a K-12 educational outreach program through partnerships with UCD, Colorado Mathematics, Engineering and Science Achievement and the Denver Schools of Science and Technology.

12. Existing Local and Regional Advanced Transportation Technology Investments Plan

Currently, Denver invests over $150 million annually on capital improvements, including critical maintenance and rehabilitation projects, high priority capital investments, and leveraging state and federal dollars. Partnered with DRCOG, Denver has a long history of developing, designing, implementing, and maintaining ITS devices. Through Congestion Mitigation and Air Quality Federal Funding two main ITS funding mechanisms have been established. The Transportation Improvement Program (TIP) is used by Denver to implement transportation projects with objectives to address air quality issues. The Traffic Signal System Improvement Program (TSSIP) is an operations improvement tool used by Denver. Benefits for both types of projects are demonstrated through air quality improvement data and reporting. The following projects are some of the current ITS projects:

- *Transit Signal Priority (TSP) Pilot Project.* Denver in collaboration with the Regional Transportation District successfully implemented a pilot TSP on Colorado Boulevard. The results of this pilot implementation illustrated that TSP is technically feasible.
- *Center-to-Center Demonstration*. DRCOG, Denver, Littleton, Englewood, and CDOT completed a demonstration project involving center-to-center communications between traffic signal systems at neighboring agencies. The purpose of the demonstration project was to control the group of signals operated and maintained by several agencies on Santa Fe Drive in response to changes in traffic volume, generally due to a diversion from the freeway.
- *Bicycle Detection.* Funds were allocated to Denver for pilot implementations of bicycle detection. Bicycle detection will allow more efficient operations while continuing to accommodate bicyclists.
- *CMAQ Benefits of Uninterruptible Power Supplies and Ethernet Conversion*. The implementation of Uninterruptible Power Supplies (UPS) and Ethernet Communications protocol both condition the power for the controllers and maintain signal operations during power interruptions. Both of these functions help the signal system provide more reliable operations.

Table 8. Current CMAQ TSSIP projects:

TSSIP Fiscal Year Expenditures					
Projects	**FY 2013/14**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**
Denver Colorado Blvd: 1st Ave - 50th Ave Speer Blvd: Elitch - 13th Ave X		$1,078,000			
Central Business District (CBD) Ph 1					$1,222,000
Central Business District (CBD) Ph 2			$1,029,000	$1,060,000	
DTC Blvd: Tamarac St - Union Ave					
Colorado: Hampden to 1st	$484,000				

TSSIP Fiscal Year Expenditures					
Projects	**FY 2013/14**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**
Colfax: Sheridan to I-25	$747,000				
Colfax: Logan to Yosemite					

Table 9. Current TIP projects

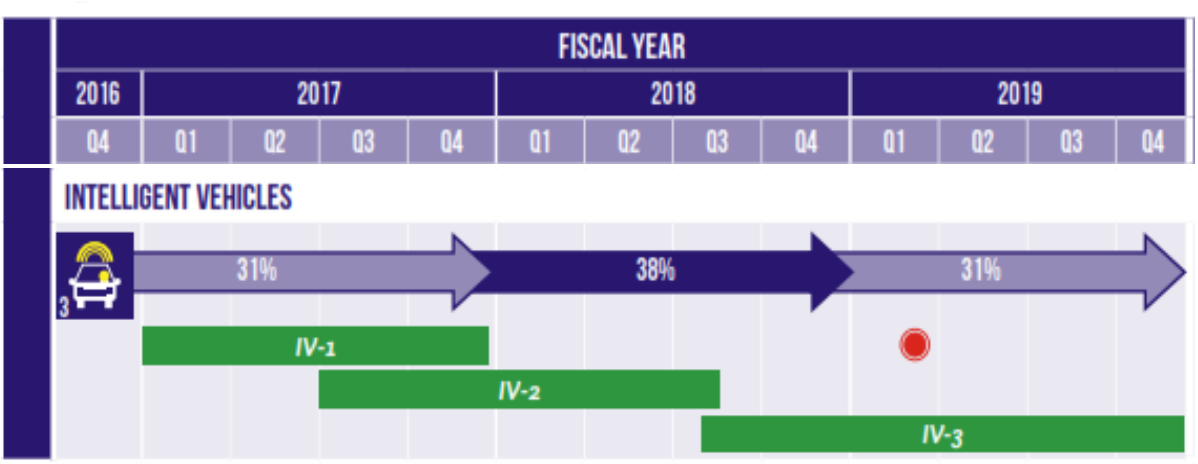
Denver TIP Fiscal Year Expenditures					
City Wide Implementation Projects	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**	**Total**
Federal Portion	$1,090,000	$1,340,000	$1,344,000	$1,026,000	$4,800,000
Denver Match	$542,000	$666,000	$668,000	$509,000	$2,385,000
Total	$1,632,000	$2,006,000	$2,012,000	$1,535,000	$7,185,000

These projects represent existing and future ITS infrastructure investments which all serve as standalone data sources and strategies. The IV-1 project will integrate all Denver TMC data sources, including the aforementioned investments, to leverage every available resource. Projects IV-2 and IV-3 will be implemented in areas that are long overdue for technology investment. As there is a lack of existing technology for these projects to leverage, IV-2 and IV-3 will become the foundation upon which future projects can build. However, our staggered implementation approach for these projects will allow IV-2 and IV-3 to build off the technology foundation established by IV-1.

13. Deployment Schedule

Figure 5 (below) provides a high-level summary of the deployment schedule for the proposed IV Projects across the three-year period of performance beginning in Quarter 4 of 2016. The IV projects will be delivered with a staggered approach. The percentages shown in Figure 5 represent the percentage spent. Quarter 4 of 2016, beginning October 1, will begin the project initiation phase. This will include the kick-off meeting within four weeks after the grant is awarded, as well as monthly reports. Delivery of project IV-1 will occur in 2017, IV-2 in 2018, and IV-3 in 2019. These time periods also include monthly reports as well as an annual report to the Secretary. Additionally, Denver has a commitment to evaluate the effectiveness of these IV Projects, including the cost-benefit.

Figure 5. Deployment Schedule



14. Innovative Technology Initiatives

Smart City and CV technologies provide an exciting opportunity to revitalize the transportation network with transformative data analytics and powerful applications, and are another form of ITS that should adhere to the national and regional vision for ITS architecture, standards and certification processes.

The Smart City Program will require expanding our ITS Regional Architecture in order to establish the framework for Smart City and CV concepts to be implemented across the metro area. This will position the entire region as an agent of change and a benchmark for the nation. We will jumpstart an update to the architecture by leveraging CDOT's RoadX project and the available architecture and standards work completed by the USDOT for CV concepts. The USDOT's CV Reference Implementation Architecture (CVRIA) provides the physical, functional, communications and enterprise architecture viewpoints as guidance for implementing CV applications. More importantly, the CVRIA was built to ensure CV deployments fit into the greater National ITS Architecture, enabling a standards-based implementation that will ensure the new system can be seamlessly integrated into existing transportation management and ITS systems for the region and as a model for additional Smart Cities to follow.

For CV technologies, Denver will coordinate with USDOT-appointed certification bodies in the selection and procurement of all DSRC devices and utilize the newly developed Crash Avoidance Metrics Partnership (CAMP) security certificate management system processes and procedures for the deployment and management of security certificates for DSRC devices. For all Smart City or CV architecture and standards activities, Denver will engage and coordinate with national and international standards development organizations to ensure future deployments benefit from the experiences and lessons learned from the Denver implementation. Attachment F showcases how Denver will leverage existing and innovative technology initiatives from USDOT and standards organizations throughout our Smart City deployment.

B. Staffing Description

1. Staffing Organization

For this program, Denver carefully identified the necessary project team of city staff (including two new positions) who will participate in and lead the effort. Our staff will be supplemented by contractor support from Jacobs Engineering, Econolite, and Peloton Technology. CDOT will provide additional regional partner support. Jacobs Engineering will be responsible for IV Project management (see Section A2, under Program Management Approach), overseen by key

City Staff including:

Steve Hersey, City Traffic Engineer, IV Project Manager. Steve is Denver's co-lead for Connected and Autonomous Vehicles, and has a wealth of experience dating back to 1993 when he began working for CDOT in the Traffic Engineering group. His extensive work on Colorado's first managed lane corridor, including tolling and active traffic management infrastructure, will be invaluable on this program. His ability to integrate traditional traffic engineering systems with connected and autonomous vehicle technologies will help to achieve the desired project outcomes. Steve will be responsible for overseeing the scope, schedule, and budget of this project.

Michael Finochio, TMC Engineering Manager, IV Technical Manager. Michael will co-lead with Steve and is responsible for traffic operations, ranging from ITS devices to traveler information, directing construction projects, contracts, budgeting, and day-to-day operations. He serves as a subject matter expert on ITS design, implementation, and operations. Michael has close working relationships with various regional and national players in the transportation arena.

These key City staff will be supported by the SMART Council (see Section A11, Partnership Plan) and the Mayor's Executive Leadership Team (see Section A2, under Program Management Approach) for all IV Projects.

2. Primary Point of Contact

The primary point of contact for the project will be Michael Finochio:

Michael Finochio, Engineering Manager
Public Works/Transportation & Mobility, City and County of Denver
Office: 720-913-0801
E-mail: michael.finochio@denvergov.org

C. Funding Description

Table 10 below presents a breakdown of the estimated costs by proposed IV project, including an identification of the funding sources and amounts. If selected, the proposed IV projects will be funded by Denver (50% of total project funding) and through ATCMTD funds (50%). A more detailed budget estimate is included as Attachment E.

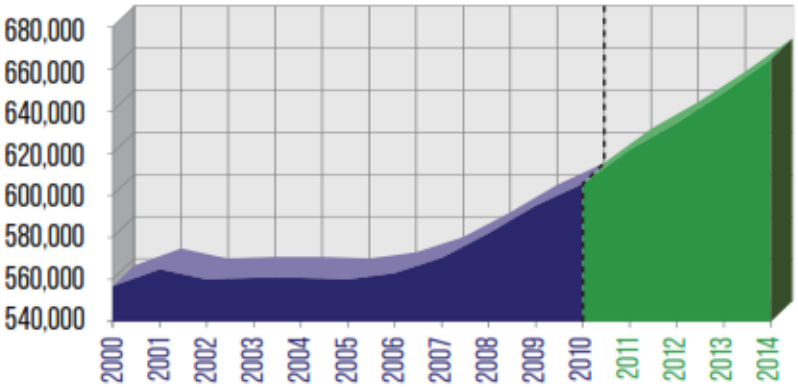
Table 10. Estimated Costs Rounded to the Nearest Dollar

Project	Denver funds	ATCMTD funds	Total
IV-1	$2,061,242	$2,061,242	$4,122,485
IV-2	$3,217,245	$3,217,246	$6,434,491
IV-3	$721,519	$721,519	$1,443,038
Total	**$6,000,007**	**$6,000,007**	**$12,000,014**

Supporting Documents
Attachment A. Denver Population Infographic

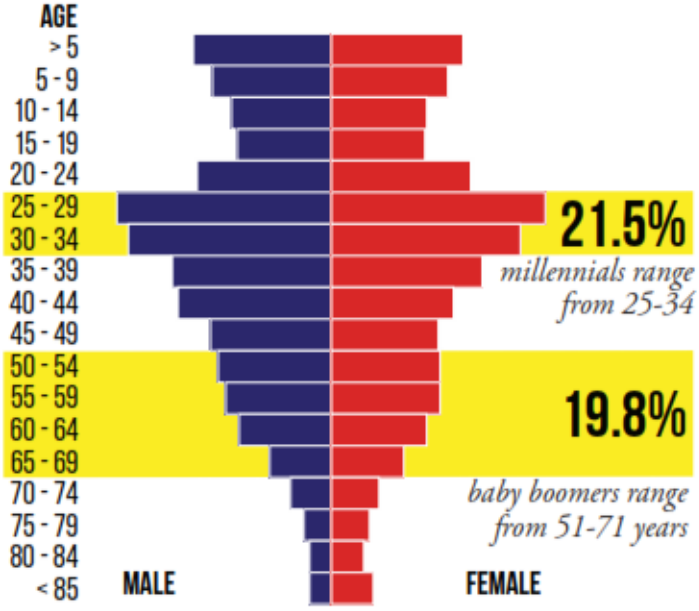
POPULATION GROWTH

Denver has seen its population grow from 467,610 in 1990 to 600,158 in 2010 – an increase of more than 28 percent in 20 years. According to the state demographer's office, Denver reached 664,220 in 2014, an additional 10 percent in just four years.



DENVER EMBRACES MULTI GENERATIONS

Denver is one of the youngest cities in the country, with millennials accounting for more than 21.5 percent of the city population. Baby boomers account for 19.8 percent.



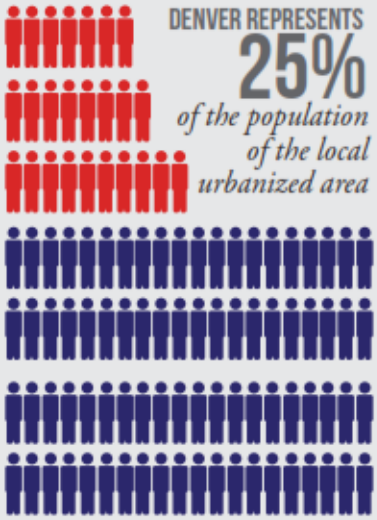
600,158 *population in 2010*

DOWNTOWN DENVER CORE

142% *increase in the number of residents since 2000*

65,974 *residents living in downtown Denver and the surrounding historic neighborhoods*

DENSE URBAN POPULATION



Attachment B. Partner Letters of Support

COLORADO
Department of Transportation
Office of the Executive Director
4201 East Arkansas Ave, Suite 262
Denver, CO 80222

June 20, 2016

The Honorable Anthony Foxx, Secretary
United States Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

RE: City and County of Denver Support Letter for ATCMTD Grant Application

Dear Secretary Foxx:

The Colorado Department of Transportation (CDOT) strongly supports the Advanced Transportation and Congestion Management Technologies Deployment Initiative (ATCMTD) application submitted by the City & County of Denver to implement Connected Traffic Management Center (TMC) and Connected Fleets; Travel Time Reliability as a City Service for Connected Freight and Safer Pedestrian Crossings for Connected Citizens.

Rapid population growth. Increased traffic congestion. Hundreds of traffic-related deaths and serious injuries each year. Air pollution. Numerous disconnected and disadvantaged communities. Those are just some of the challenges facing Denver and cities across the country. Denver was built by pioneers dedicated to achieving bold outcomes through collaborative, community-based problem solving. That spirit continues to drive us forward today. Our challenges are many, but they can be overcome.

With the ATCMTD grant, we have selected the following Intelligent Vehicles and Safety projects to address the serious challenges facing Denver today and will deliver measurable outcomes aligned with the ATCMTD goals and focus areas. These Intelligent Vehicle/Safety projects will usher in a new era of transformational technologies for Denver and the region, bringing greater mobility safety, efficiency and reliability to our transportation network.

Denver's contribution of $6.0 M of total local match demonstrates a firm belief and commitment in in these projects to improve connectivity, reliability and safety in our community. Denver staff will contribute far more through the day to day management of this funding opportunity and continuing to build out the comprehensive approach we developed through our Smart City Challenge application.

We thank you for your consideration of Denver's ATCMTD grant which will prepare us for coming advancements in automation and allow us to maximize our existing infrastructure; establish a first-in-the-nation Freight Efficiency Corridor Program, install DSRC along key routes, and offer travel time reliability as a City service using freight signal priority to incentivize freight operators to equip their fleets with DSRC; and address pedestrian crossings with new tools and technology to increase the safety of our community.

Please do not hesitate to contact me with any questions.

Sincerely,

Shailen P. Bhatt
Executive Director

4201 E. Arkansas Ave, Suite 262, Denver, CO 80222 P 303.757.9201 F 303.757.9656 www.codot.gov

ECONOLITE

Solutions that Move the World®

June 21, 2016

Robert Rupert
US Department of Transportation
1200 New Jersey Ave, SE
Mail Drop: E86-205
Washington, DC 20590

Dear Mr. Rupert:

Econolite is pleased to support the City of Denver's proposal response to the United States Department of Transportation's Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Initiative. USDOT's investments over the last 15 years in Connected Vehicle (CV) standards and related technologies establishes a framework for innovations that are inducing a transformation of ITS. The ATCMTD initiative amplifies and expedites the application of these innovations with measurable benefit to the proposer that is awarded this opportunity.

The framework of connected vehicles provides opportunity to completely redefine the interaction between vehicles and infrastructure, enabling an entirely new methodology for traffic control. Econolite has been following USDOT's lead on CV for the last 15 years and is ready to release a new CV intersection controller. This ground-breaking technology overcomes prior limitations by providing the traffic controller with geometric awareness of the intersection as well as CV trajectory data as an input for vehicle demand. We believe this broadened awareness will enable an entirely new set of traffic control strategies, optimization models, and features.

The City of Denver has long been a progressive agency that embraces new technologies and leverages the opportunities opened by USDOT. Denver has identified means for Econolite to integrate our CV-based traffic controller within their IV-2 project that focuses on Travel Time Reliability for Connected Freight. For IV-2, Econolite will help build the value proposition of CV technologies to freight companies via ETA-based signal priority for freight vehicles.

ECONOLITE

Solutions that Move the World®

This program is designed to significantly expand the operational capabilities of the CV environment by leveraging the real-time data exchanges of connected vehicles to optimize traffic flow and safety. These solutions will seamlessly connect to other integrated systems within a smart-city network infrastructure. This ensures that the critical V2I building blocks are in place and ready to help agencies, freight companies, and local businesses realize the full potential of connected vehicles.

Econolite is excited to be part of this program and provides full support to the City of Denver in their pursuit of this opportunity.

Sincerely,

Eric Raamot
Vice President, Engineering
Econolite Control Products, Inc.

3360 E. La Palma Ave • Anaheim, CA 92806-2856 • PH: (714) 630-3700 • FAX: (714) 630-6349
P.O. Box 6150 • Anaheim, CA 92816-0150 • www.econolite.com

JACOBS

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www.jacobs.com

June 23, 2016

Crissy Fanganello
Director of Transportation
Denver Public Works
City and County of Denver
201 West Colfax Avenue
Denver, CO 80202

RE: Denver's ATCMTD Grant Application

Dear Mrs. Fanganello:

I write in support of the City and County of Denver's United States Department of Transportation (USDOT) Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant application. The City and County of Denver's grant application will help the entire Denver metro area reap the benefits of a dedicated linkage between advanced technology and transportation solutions to improve mobility, increase safety, and increase efficiency.

Jacobs stands dedicated in our commitment to Denver. The capabilities of the project components included in the city's grant application will help the City assume a proactive stance with regards to congestion, safety, and efficiency while elevating Denver to a national leader in connected vehicle technology.

The ATCMTD will help enable the City and County of Denver to deliver innovative projects to help ensure residents se easing congestion, that businesses can operate more efficiently, and that pedestrians and bicyclists can move about the city in a safe manner. Jacobs strongly supports this grant application and looks forward to partnering with the City and County of Denver and other project partners in this endeavor.

Sincerely,

Julie Skeen
Rocky Mountain Operations Manager
Jacobs Engineering Group Inc.

Peloton Technology
1060 La Avenida Street
Mountain View, CA 94043
650.395.7356

www.peloton-tech.com

June 23, 2016

To: Crissy Fanganello
Director of Transportation & Mobility
Denver Public Works
City and County of Denver

Subject: Partner Letter of Support for the USDOT Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Initiative

Dear Ms. Fanganello,

I am writing to express the support of Peloton Technology for the Denver Smart City Program ATCMTD proposal to USDOT. Specifically, Peloton Technology will support the project titled IV-2, Travel Time Reliability for Connected Freight.

Peloton will support the project with expertise which encompasses Intelligent Freight Vehicles, V2V and V2I Connectivity to improve mobility, and initial forms of vehicle automation. Peloton is developing innovative ITS platooning technology for heavy vehicles that features V2X (vehicle-to-vehicle/infrastructure/cloud) communications, radar-based active safety systems, vehicle control algorithms and a cloud-based Network Operations Center (NOC) to link heavy trucks traveling along freight corridors – connecting terminals, arterials, highways and interchanges. These systems can save fuel, reduce emissions, improve safety and enhance quality of life in the City.

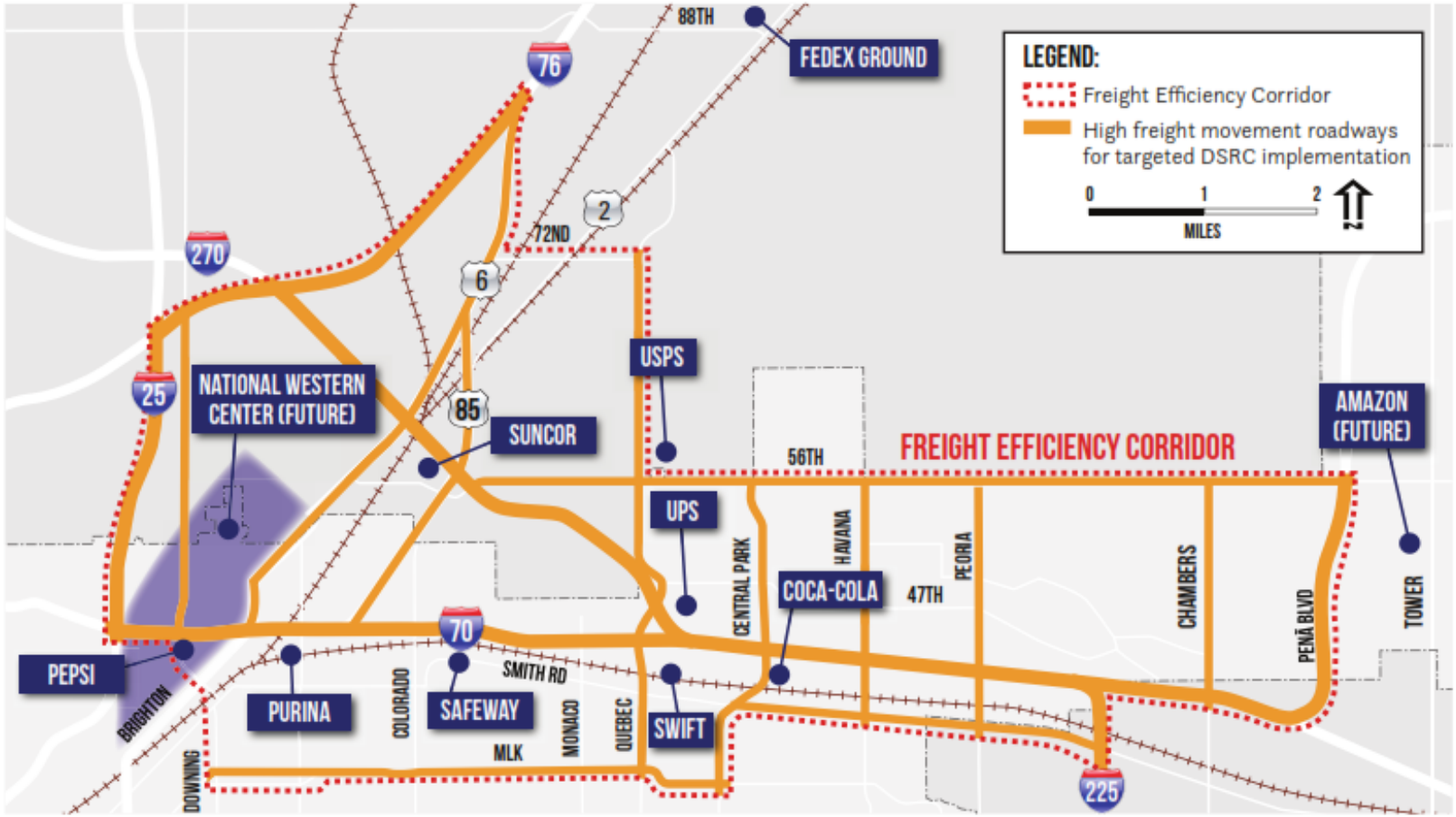
Peloton will also be pleased to serve on the IV-2 Project Leadership Team (PLT). We look forward to being a part of this exciting deployment effort.

Sincerely,

DocuSigned by:
Josh Switkes

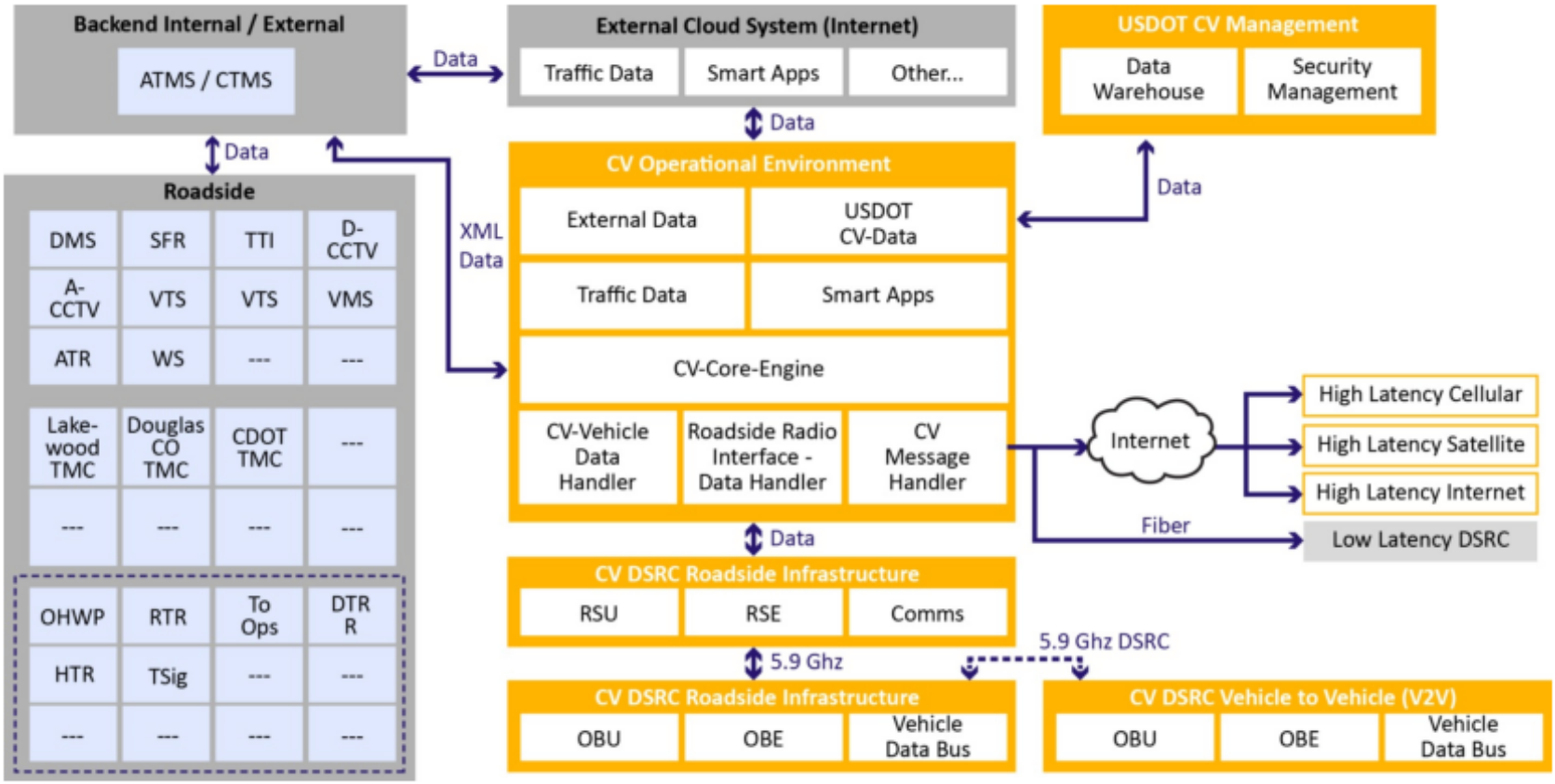
Josh Switkes
Founder & CEO
Peloton Technology

Attachment C. North Denver Freight Corridor Map



. Stretching from I-25 to Pena Boulevard, North Denver is dense with freight movement and industrial facilities and is primed for improving safety and freight efficiency. The Freight Efficiency Corridor will allow trucks access to their destinations through routes that do not disturb neighborhood communities.

Attachment D. Context Diagram for Denver TMC CV Operational Environment



Attachment E. Detailed IV Project Budgets

13. Annual Spend Plan - Intelligent Vehicles

Version 1, dated June 19, 2016

INTELLIGENT VEHICLES

FUNDING	*$12,000,014*
ATCMTD Funded	$5,930,052
City Funded	$6,069,962

INTELLIGENT VEHICLES - YEARLY SPEND PLAN

Materials	Unit	Cost per Unit	Total $ 3 year Investment	FY2016 0%	FY2017 20%	FY2018 50%	FY2019 30%	Investment after FY2019 15%
IV-1, Connected Traffic Management Center and Connected Fleets								
Waze Connected Citizens Program - FREE	0	$ -	$ -	$ -	$ -	$ -	$ -	
DSRC Onboard Units	1500	$ 1,200	$ 1,800,000	$ -	$ 360,000	$ 900,000	$ 540,000	
Annual Requirements/Config Management Software License	3	$ 5,000	$ 15,000	$ -	$ 3,000	$ 7,500	$ 4,500	
IV-2, Travel Time Reliability for Connected Freight								
DSRC Roadside Units	50	$ 2,500	$ 125,000	$ -	$ 25,000	$ 62,500	$ 37,500	
Roadside Signage	161	$ 1,000	$ 161,000	$ -	$ 32,200	$ 80,500	$ 48,300	
Peloton	1	$ 165,000	$ 165,000	$ 4,489	$ 53,429	$ 55,032	$ 52,050	
Econolite	1	$ 542,000	$ 542,000	$ 14,746	$ 175,506	$ 180,771	$ 170,977	
IV-3, Safer Pedestrian Crossing for Connected Citizens								
Roadside Cabinets	4	$ 25,000	$ 100,000	$ -	$ 20,000	$ 50,000	$ 30,000	
Detection	4	$ 40,000	$ 160,000	$ -	$ 32,000	$ 80,000	$ 48,000	
Communications	4	$ 8,000	$ 32,000	$ -	$ 6,400	$ 16,000	$ 9,600	
Signs and Markings	4	$ 5,000	$ 20,000	$ -	$ 4,000	$ 10,000	$ 6,000	
RR flashers and Poles	4	$ 10,000	$ 40,000	$ -	$ 8,000	$ 20,000	$ 12,000	
DSRC Roadside Units	4	$ 2,500	$ 10,000	$ -	$ 2,000	$ 5,000	$ 3,000	
Total Direct Materials			**$ 3,170,000**	**$ 19,235**	**$ 721,535**	**$ 1,467,303**	**$ 961,927**	**$ 475,500**
% of Spending per Year				**1%**	**23%**	**46%**	**30%**	

Labor	City / Contract	FTE	NEW % Effort	Hourly Labor Rate	Total $ 3 year Investment		+ 3% Escalation from previous year	+ 3% Escalation from previous year	+ 3% Escalation from previous year	8%
IV-1, Connected Traffic Management Center and Connected Fleets										
Engineering/Design										
CV Senior Systems Architect/System Engineers	Contract	2.5	25.0%	$ 102	$ 423,386	$ 11,519	$ 137,098	$ 141,210	$ 133,559	
CV Application/Software Developer	Contract	2	25.0%	$ 95	$ 315,260	$ 8,577	$ 102,085	$ 105,147	$ 99,450	
CV Security/Network Engineer	Contract	2	15.0%	$ 102	$ 203,225	$ 5,529	$ 65,807	$ 67,781	$ 64,108	
Traffic Engineer, Steve Hersey	City	1	33%	$ 48	$ 105,753	$ 2,877	$ 34,244	$ 35,271	$ 33,360	
Technician - City	City	1	33%	$ 38	$ 83,721	$ 2,278	$ 27,110	$ 27,923	$ 26,410	
Install										
ITS Engineer/Electrical Engineer	Contract	2	25.0%	$ 75	$ 248,107	$ 6,750	$ 80,340	$ 82,750	$ 78,267	
Traffic Signal & Elec Technician	Contract	2	25.0%	$ 60	$ 198,485	$ 5,400	$ 64,272	$ 66,200	$ 62,613	
IV-2, Travel Time Reliability for Connected Freight										
Engineering/Design										

13. Annual Spend Plan - Intelligent Vehicles

Version 1, dated June 19, 2016

	Urban Planners	Contract	2	15.0%	$ 120	$ 237,617	$ 6,465	$ 76,943	$ 79,252	$ 74,958	
	Freight SME/ Industry Coordinator	Contract	2	15.0%	$ 87	$ 171,960	$ 4,678	$ 55,683	$ 57,353	$ 54,246	
	CV Senior Systems Architect/System Engineers	Contract	2.5	50.0%	$ 102	$ 846,772	$ 23,037	$ 274,195	$ 282,421	$ 267,119	
	CV Application/Software Developer	Contract	3	50.0%	$ 95	$ 945,779	$ 25,731	$ 306,255	$ 315,442	$ 298,351	
	CV Security/Network Engineer	Contract	2	50.0%	$ 102	$ 677,417	$ 18,430	$ 219,356	$ 225,937	$ 213,695	
	Traffic Engineer, Steve Hersey	City	1	33%	$ 48	$ 105,753	$ 2,877	$ 34,244	$ 35,271	$ 33,360	
	Technician - City	City	1	33%	$ 38	$ 83,721	$ 2,278	$ 27,110	$ 27,923	$ 26,410	
Install											
	Signal Timing Engineer/Traffic Modeler	Contract	2	15.0%	$ 100	$ 198,485	$ 5,400	$ 64,272	$ 66,200	$ 62,613	
	Traffic Control/MOT	Contract	2	15.0%	$ 75	$ 148,864	$ 4,050	$ 48,204	$ 49,650	$ 46,960	
	ITS Engineer/Electrical Engineer	Contract	2	25.0%	$ 75	$ 248,107	$ 6,750	$ 80,340	$ 82,750	$ 78,267	
	Traffic Signal & Elec Technician	Contract	2	25.0%	$ 60	$ 198,485	$ 5,400	$ 64,272	$ 66,200	$ 62,613	
IV-3, Safer Pedestrian Crossing for Connected Citizens											
Engineering/Design											
	Traffic Engineer	Contract	1	10.0%	$ 120	$ 79,206	$ 2,155	$ 25,648	$ 26,417	$ 24,986	
	Traffic Engineer, Steve Hersey	City	1	10%	$ 48	$ 31,758	$ 864	$ 10,284	$ 10,592	$ 10,018	
	Technician - City	City	1	10%	$ 38	$ 25,141	$ 684	$ 8,141	$ 8,385	$ 7,931	
Install											
	Signal Timing Engineer/Traffic Modeler	Contract	1	10.0%	$ 100	$ 66,162	$ 1,800	$ 21,424	$ 22,067	$ 20,871	
	Traffic Control/MOT	Contract	1	10.0%	$ 75	$ 49,621	$ 1,350	$ 16,068	$ 16,550	$ 15,653	
	ITS Engineer/Electrical Engineer	Contract	1	10.0%	$ 75	$ 49,621	$ 1,350	$ 16,068	$ 16,550	$ 15,653	
	Traffic Signal & Elec Technician	Contract	1	10.0%	$ 60	$ 39,697	$ 1,080	$ 12,854	$ 13,240	$ 12,523	
Total Direct Labor						**$ 5,782,105**	**$ 157,308**	**$ 1,872,316**	**$ 1,928,486**	**$ 1,823,995**	**$ 462,568**
% of Spending per Year							**3%**	**32%**	**33%**	**32%**	

Labor Overhead	City / Contr	FTE	NEW % Effort	Labor Rate (+ X% burden)	Total $ 3 year Investment		+ 3% Escalation from previous year	+ 3% Escalation from previous year	+ 3% Escalation from previous year	10%
IV-1, Connected Traffic Management Center and Connected Fleets										
System Development Lead	Contract	1	33.0%	$ 131	$ 285,453	$ 7,766	$ 92,433	$ 95,206	$ 90,048	
Project Manager, Michael Finochio	City	1	33.0%	$ 48	$ 104,800	$ 2,851	$ 33,936	$ 34,954	$ 33,060	
IV-2, Travel Time Reliability for Connected Freight										
System Development Lead	Contract	1	33.0%	$ 131	$ 285,453	$ 7,766	$ 92,433	$ 95,206	$ 90,048	
Project Manager, Michael Finochio	City	1	33.0%	$ 48	$ 104,800	$ 2,851	$ 33,936	$ 34,954	$ 33,060	
Senior Program Developer	Contract	1	100.0%	$ 107	$ 708,683	$ 19,280	$ 229,480	$ 236,365	$ 223,558	
Community Liason	Contract	1	100.0%	$ 63	$ 416,872	$ 11,341	$ 134,988	$ 139,038	$ 131,505	
IV-3, Safer Pedestrian Crossing for Connected Citizens										
System Development Lead	Contract	1	33.0%	$ 131	$ 285,453	$ 7,766	$ 92,433	$ 95,206	$ 90,048	
Project Manager, Michael Finochio	City	1	33.0%	$ 48	$ 104,800	$ 2,851	$ 33,936	$ 34,954	$ 33,060	
Total Overhead					**$ 2,296,316**	**$ 62,474**	**$ 743,575**	**$ 765,882**	**$ 724,385**	**$ 229,631.61**
% of Spending per Year						**3%**	**32%**	**33%**	**32%**	

Other Direct Cost			Unit	Cost per Unit	Total $ 3 year Investment	3%	32%	33%	32%	10%
IV-1, Connected Traffic Management Center and Connected Fleets										
Contingency - Material			10%		$ 181,500.00	$ 4,938	$ 58,772	$ 60,535	$ 57,255	

13. Annual Spend Plan - Intelligent Vehicles

Version 1, dated June 19, 2016

Contingency - Install Labor			10%		$ 157,794	$ 4,293	$ 51,096	$ 52,628	$ 49,777		
IV-2, Travel Time Reliability for Connected Freight											
Contingency - Material			10%		$ 28,600.00	$ 778	$ 9,261	$ 9,539	$ 9,022		
Contingency - Install Labor			10%		$ 34,121	$ 928	$ 11,049	$ 11,380	$ 10,764		
IV-3, Safer Pedestrian Crossing for Connected Citizens											
Contingency - Material			10%		$ 31,200.00	$ 849	$ 10,103	$ 10,406	$ 9,842		
Contingency - Install Labor			10%		$ 318,378	$ 8,662	$ 103,095	$ 106,188	$ 100,434		
Total Direct Cost					**$ 751,593**	**$ 20,448**	**$ 243,375**	**$ 250,676**	**$ 237,094**	**$ 75,159**	
% of Spending per Year						**3%**	**32%**	**33%**	**32%**		

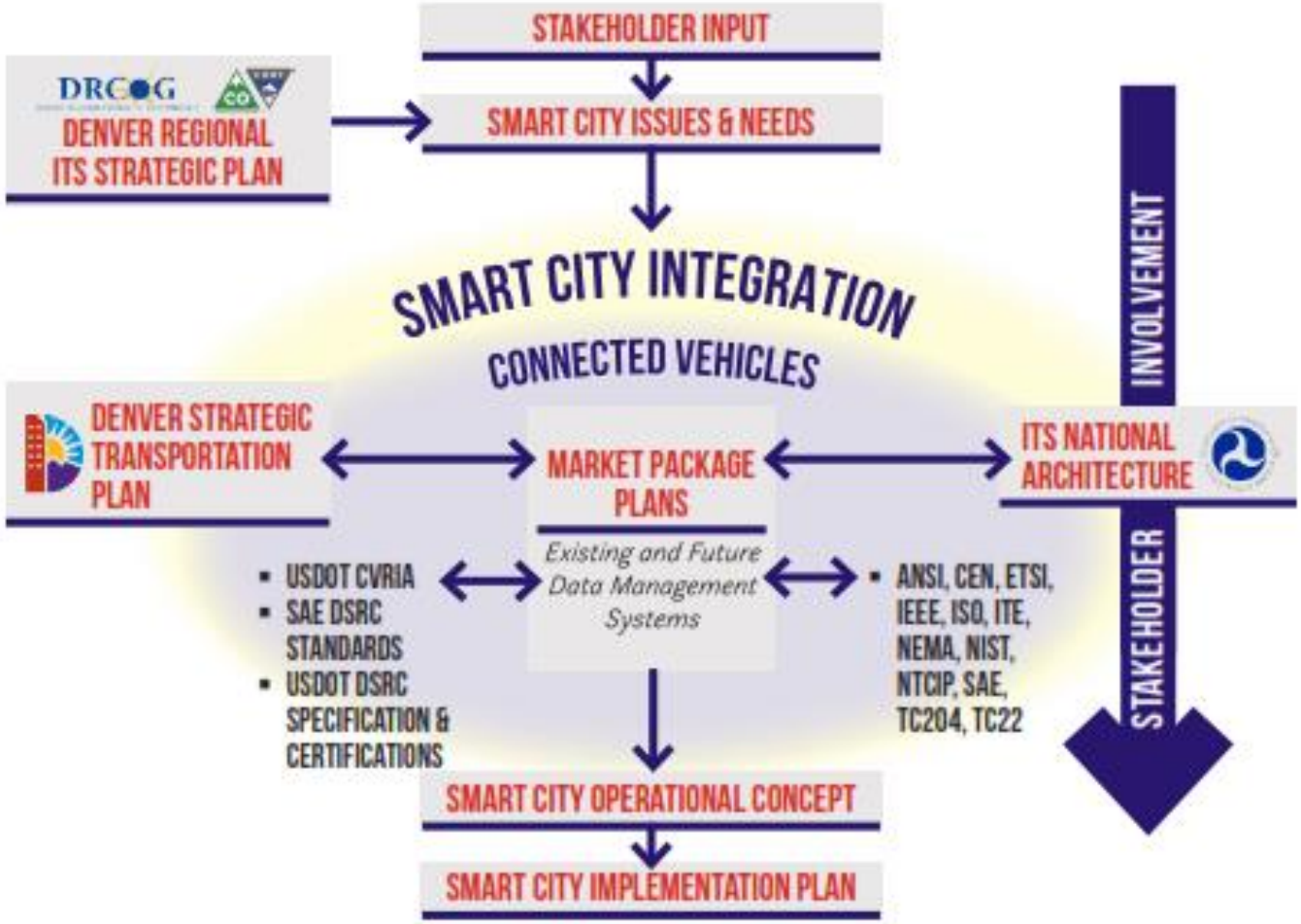
GRAND TOTAL - Cost					**$ 12,000,014**	**$ 259,464**	**$ 3,580,801**	**$ 4,412,347**	**$ 3,747,401**	**$ 1,242,859**	
% of Spending per Year						**2%**	**30%**	**37%**	**31%**		

FUNDING	**$12,000,014**
ATCMTD Funded	$5,930,052
City Funded	$6,069,962

		ATCMTD	Denver
BY PROJECTS	**$ 12,000,014**	$ 6,000,007	$ 6,000,007
IV-1, Connected Traffic Management Center and Connected Fleets	$ 4,122,485	$ 2,061,242	$ 2,061,242
IV-2, Travel Time Reliability for Connected Freight	$ 6,434,491	$ 3,217,245	$ 3,217,245
IV-3, Safer Pedestrian Crossing for Connected Citizens	$ 1,443,038	$ 721,519	$ 721,519

	2016	2017	2018	2019
IV-1, Connected Traffic Management Center and Connected Fleets	$ 62,777.49	$ 1,110,191.66	$ 1,677,107.41	$ 1,272,408.01
IV-2, Travel Time Reliability for Connected Freight	$ 167,276.02	$ 2,048,156.34	$ 2,193,685.03	$ 2,025,373.39
IV-3, Safer Pedestrian Crossing for Connected Citizens	$ 29,410.76	$ 422,453.45	$ 541,555.06	$ 449,619.21

Attachment F. Approach to Updating Regional ITS System Leveraging Technology



Denver will integrate its Smart City Program into the existing ITS Architecture process; utilize USDOT, SAE, IEEE, and other relevant standards; and engage the appropriate standards development stakeholders for new Smart City concepts.

OMB Approval No. 4040-0006
Expiration Date 07/30/2010

BUDGET INFORMATION - Non-Construction Programs

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1.		$	$	$	$	$
2.						
3.						
4.						
5. Totals		$	$	$	$	$

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1)	(2)	(3)	(4)	Total (5)
a. Personnel	$	$	$	$	$
b. Fringe Benefits					
c. Travel					
d. Equipment					
e. Supplies					
f. Contractual					
g. Construction					
h. Other					
i. Total Direct Charges (sum of 6a-6h)					$
j. Indirect Charges					$
k. TOTALS (sum of 6i and 6j)	$	$	$	$	$
7. Program Income	$	$	$	$	$

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e)TOTALS
8.	$	$	$	$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	$	$	$	$

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$	$	$	$	$
14. Non-Federal	$				
15. TOTAL (sum of lines 13 and 14)	$	$	$	$	$

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (YEARS)			
	(b)First	(c) Second	(d) Third	(e) Fourth
16.	$	$	$	$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	$	$	$	$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:

22. Indirect Charges:

23. Remarks:

Project Oversight Agreement

The Federal Highway Administration (FHWA) anticipates substantial Federal involvement between the CO Division of FHWA and the City and County of Denver throughout the course of the ATCMTD project. The anticipated federal involvement will include: technical assistance and guidance; approved actions as defined here in this document; and participation in project development and technical meetings.

Due to the deployment of new connected vehicle and other innovative technologies the FHWA Colorado Division has designated this project a Project of Division Interest (PODI). This designation is consistent with other current Connected Vehicle (CV) deployments in Colorado which are also designated as PODIs, as well as with other states' deployments of Connected Vehicle technologies and ATCMTD grants.

PODIs are projects that present a meaningful opportunity for FHWA involvement to enhance overall program objectives. As part of this PODI designation the Division has prepared a project-specific Stewardship and Oversight Plan. This serves to outline the working relationship between the City and County of Denver and the FHWA.

A. PROJECT RISK ASSESSMENT

FHWA considers the risks to the delivery of the project in the determination of the level of oversight would be provided to each project. A risk assessment is performed for each project for the following categories:

1. Complexity,
2. Cost,
3. Schedule,
4. Funding,
5. Environmental Considerations,
6. Project Administration,
7. National/Regional Significance,
8. Urgency,
9. Corporate Actions, and
10. Local Considerations.

The results from the risk analysis tool highlights the major risk areas on the project and provides a categorical triage (i.e., High, Medium, or Low) as to how each of those risk areas applies to this project. The following table summarizes the risk analysis results for this project:

Risk Area	Risk Ranking (H/M/L)	Risk Description/ Comments
Complexity	H	• High risk ITS project (H)

Cost	L	• Less than 25% of the City's transportation budget (L) • Less than $750 million in total project cost (L) • Low risk of cost creep (CER) (L) • More than 20% Federal Assistance (H)
Schedule	L	• Simple schedule with few project interfaces (L). • Insignificant schedule risk because of utility or right of way impacts (L). • Medium risk of schedule change/delays due to software development challenges as well as private sector/stakeholder commitment to participate (M).
Urgency	L	• Project is currently proceeding as planned and has no significant issues (L) • Current phase of project is expected to be completed in the next year or so with no significant issues (L) • Minimal political/stakeholder interests and involvement in current phase of project (L)
Environmental Considerations	L	• Project likely requires a Categorical Exclusion (CE), i.e. minimum environmental impacts and project mitigation (L) • Little opposition to project and low risk of legal challenges (L)
Funding	L	• Project is funded with traditional local, and federal funds (L) • All project funding will be identified in a state planning document such as a State Transportation Improvement Plan (STIP) as well as the TIP (L)
Project Administration	M	• Project is the City of Denver with some experience and acceptable past performance of delivering similar projects (M/H) • Project sponsor has adequate resources to deliver the project (L) • Project procurement is expected to follow the traditional ITS process (L) • Low risk of issues meeting Federal Regulations, e.g. DBE, Buy America, Uniform Act, improper payments, and construction quality assurance (M)
National/Regional Significance	M	• Interstate project impacting over 150,000 ADT • Provides congestion relief and air quality improvement (L)
Corporate Actions	L	• No significant project elements, protocols or features have been identified that will impact or influence a FHWA national goal and no corporate activities are anticipated in the next year (L)

B. PROJECT ELEMENTS FOR FHWA INVOLVEMENT

Based on the areas identified, FHWA has considered the following elements of program delivery as providing an opportunity for added value by its involvement. The specific activities that FHWA will be involved are listed in Section C, but the elements target for involvement are the following:

☒ Project Authorization and Project Agreement
☒ Project Planning and Programming
☒ Project Financing
☒ Environmental Clearances/NEPA
☒ Preliminary Design (Systems Engineering Management Plan and Concept of Operations, and other documents deemed appropriate by FHWA, depending on the project elements)
☒ Final Design
☒ Plan, Specification, & Estimate Development
☒ Advertising and Award
☐ Innovative Contracting/Design Build
☒ Contract Administration
☒ Construction Inspection & Quality (Verification of System)
☒ Other – Describe: Compliance with the ATCMD Cooperative Agreement reporting requirements

C. PROJECT ACTIVITIES FOR FHWA INVOLVMENT

Based on project risks, and project elements in which FHWA involvement would add value, specific actions to be taken by FHWA on this Project should be selected. Choose from the following actions below, and then provide a more detailed description of what that action will entail.

☒ Retained Project Approval Actions

See attachment A for a detailed accounting of who will take responsibility for each project approval action. Quarterly invoices will be required by the ATCMTD grant.

☒Project/Technical Meetings

If FHWA plans to regularly attend and participate in project/technical meetings, check this box.

FHWA anticipates attending project design and stakeholder meetings, selectively. FHWA expects City of Denver to inform FHWA of all upcoming meetings for FHWA to determine if it's necessary to participate.

☒Document/Plan Review

If FHWA plans to review the plans and/or documents prepared for this project (beyond those that would be reviewed for a required approval action in the first section), check this box. Provide a brief description of which documents and plans will be reviewed.

☐Field Review/Inspection & Report

If FHWA plans to conduct field reviews or inspections on this project, check this box. Provide a brief description of the anticipated frequency of these inspections and for which phases of the project.

☐Program/Process Reviews & Report

If FHWA plans to include this project in any risk-based program or process reviews, check this box. Provide a brief description of the risk and which review would be including this project.

☐CAP Review

If FHWA plans to include this project in a CAP review, check this box. Provide a brief description of which year of CAP would include it.

☒Special Review

IF FHWA plans to conduct any other sort of special review that includes this project, check this box. Provide a brief description of the review and how this project will be included. 2 CFR 200 Risk Assessment.

☒Other – Describe:

If FHWA plans any other specific project level actions and involvement not otherwise reflected in this POA, check this box.

FHWA AOR (Agreement Officer's Representative) and the CO DIV Program Oversight Manager (POM) shall work to ensure reporting requirements outlined in the Grant Agreement are met by City of Denver.

ATTACHMENT A
PROJECT ACTION RESPONSIBILITY MATRIX
ATCMTD

PROJECT ACTION RESPONSIBILITY MATRIX		
ACTION	**Agency to Approve/Concur**	
PROGRAMMING (All phases)		
Ensure project in Statewide Transportation Improvement Program (STIP)/Transportation Improvement Program (TIP)		City of Denver
Identify proposed funding category		City of Denver
FINANCIAL MANAGMENT (All phases)		
Obligate funds/approve Federal-aid project agreement, modifications, and project closures (project authorizations) (Note: this action cannot be assumed by State)		FHWA
Authorize current bill (Note: this action cannot be assumed by State)		FHWA
ATCMTD Quarterly Invoice and Report		FHWA
ENVIRONMENT (All phases)		
All EA/FONSI, EIS/ROD, 4(f), 106, 6(f) and other approval actions required by Federal environmental laws and regulations. (Note: this action cannot be assumed by STATE except under 23 U.S.C. 327)		FHWA
Categorical Exclusion approval actions (Note this action cannot be assumed by the State except through an assignment under 23 U.S.C. 326 or 327, or through a programmatic agreement pursuant to Section 1318(d) of MAP-21 and 23 CFR 771.117(g)))		FHWA
PRELIMINARY DESIGN (Design Phase)		

PROJECT ACTION RESPONSIBILITY MATRIX		
ACTION		**Agency to Approve/Concur**
Consultant Contract Selection		FHWA
Sole source Consultant Contract Selection		FHWA
Approve hiring of consultant to serve in a "management" role (Note: this action cannot be assumed by State) [23 CFR 172.9]		FHWA
Approve consultant agreements and agreement revisions (Federal non-Major Projects) [23 CFR 172.9]		City of Denver
Approve exceptions to design standards [23 CFR 625.3(f)]		City of Denver
Interstate System Access Change [23 USC 111] (Note: this action cannot be assumed by State)		FHWA
Interstate System Access Justification Report [23 USC 111] (Note: action may be assumed by State pursuant to 23 USC 111(e))		FHWA
Airway highway clearance coordination and respective public interest finding (if required) [23 CFR 620.104]		City of Denver
Concur on Award		FHWA
DETAILED / FINAL DESIGN (Design Phase)		
Approve retaining right-of-way encroachments [23 CFR 1.23 (b) & (c)]		FHWA
Approve use of local force account agreements [23 CFR 635.104 & 204]		City of Denver
Approve use of publicly owned equipment [23 CFR 635.106]		City of Denver
Approve the use of proprietary products, processes [23 CFR 635.411]		FHWA

PROJECT ACTION RESPONSIBILITY MATRIX		
ACTION	**Agency to Approve/Concur**	
RIGHT-OF-WAY (Design and Operational Phases)		
Make feasibility/practicability determination for allowing authorization of construction prior to completion of ROW clearance, utility and railroad work [23 CFR 635.309(b)]		FHWA
Make public interest finding on whether State may proceed with bid advertisement even though ROW acquisition/relocation activities are not complete for some parcels [23 CFR 635.309(c)(3)]		FHWA
Ensure compliant ROW certificate is in place [23 CFR 635.309(c)]		City of Denver
Approve Hardship and Protective Buying [23 CFR 710.503] (If a Federal-aid project) (Note: this action cannot be assumed by State)		FHWA
Approve Interstate Real Property Interest Use Agreements [23 CFR 710.405] (Note: this action cannot be assumed by State)		FHWA
Approve non-highway use and occupancy [23 CFR 1.23(c)]		FHWA for Interstate City of Denver for Non-Interstate
Approve disposal at less than fair market value of federally funded right-of-way, including disposals of access control [23 U.S.C. 156] (Note: this action cannot be assumed by State)		FHWA
Approve disposal at fair market value of federally funded right-of-way, including disposals of access control [23 CFR 710.409] (Note: 23 CFR 710.201 authorizes FHWA and STATE to agree to		FHWA for Interstate City of Denver for Non-Interstate

PROJECT ACTION RESPONSIBILITY MATRIX		
ACTION	**Agency to Approve/Concur**	
scope of property-related oversight and approvals for all actions except those on the Interstate System)		
Functional replacement of property [23 CFR 710.509] (Note: this action cannot be assumed by State)		FHWA
SYSTEM OPERATIONS AND PRESERVATION (Design Phase)		
Accept Transportation Management Plans (23 CFR 630.1012(b))		City of Denver
Approval of System Engineering Analysis (for ITS) [23 CFR 940.11]		FHWA
PS&E AND ADVERTISING (Design Phase)		
Approve PS&E [23 CFR 635.309 (a)]		FHWA
Authorize advance construction and conversions [23 CFR 635.309] (Note: this action cannot be assumed by State)		FHWA
Approve utility or railroad force account work [23 CFR 645.113 & 646.216]		City of Denver
Approve utility and railroad agreements [23 CFR 645.113 & 646.216]		City of Denver
Approve use of consultants by utility companies [23 CFR 645.109(b)]		City of Denver
Approve exceptions to maximum railroad protective insurance limits [23 CFR 646.111]		City of Denver
Authorize (approve) advertising for bids [23 CFR 635.112, 309]		FHWA
CONTRACT ADVERTISEMENT AND AWARD (Design Phase) **All contracts to be done by competitive bidding unless otherwise authorized by law**		

PROJECT ACTION RESPONSIBILITY MATRIX	
ACTION	**Agency to Approve/Concur**
Approve cost-effectiveness determinations for construction work performed by force account or by contract awarded by other than competitive bidding [23 CFR 635.104 &.204]	City of Denver
Approve emergency determinations for contracts awarded by other than competitive bidding [23 CFR 635.104 &.204]	FHWA
Approve advertising period less than 3 weeks [23 CFR 635.112]	FHWA
Approve addenda during advertising period [23 CFR 635.112]	City of Denver
Concur in award of contract [23 CFR 635.114]	FHWA
Concur in rejection of all bids [23 CFR 635.114]	FHWA
Concur Design-Build Requests-for-Proposals and Addenda [23 CFR 635.112]	FHWA
CONSTRUCTION (Construction Phase)	
Approve changes and extra work [23 CFR 635.120]	FHWA
Approve contract time extensions [23 CFR 635.120]	City of Denver
Concur in use of mandatory borrow/disposal sites [23 CFR 635.407]	City of Denver
Accept materials certification [23 CFR 637.207]	FHWA
Concur in settlement of contract claims [23 CFR 635.124]	FHWA
Concur in termination of construction contracts [23 CFR 635.125]	City of Denver
Waive Buy America provisions [23 CFR 635.410] (Note: this action cannot be assumed by State)	FHWA

PROJECT ACTION RESPONSIBILITY MATRIX		
ACTION	**Agency to Approve/Concur**	
Final inspection/acceptance of completed work [23 USC 114(a)]		FHWA
CIVIL RIGHTS (All phases)		
Approval of Disadvantaged Business Enterprise (DBE) Project Contract Goal as per 49 CFR 26.51(d). [49 CFR 26.51(e)(3)]		City of Denver
Acceptance of Bidder's Good Faith Efforts to Meet Contract Goal [49 CFR 26.53] or of Prime Contractor's Good Faith Efforts to Find Another DBE Subcontractor When a DBE Subcontractor is Terminated or Fails to Complete Its Work [49 CFR 26.53(g)] (Note: this action cannot be performed by the FHWA)		City of Denver
Equal Employment Opportunity (EEO) Contract Compliance Review [23 CFR Part 230, Subpart D]).		City of Denver
Training Special Provision – Approval of Project Goal for training slots or hours [23 CFR Part 230, Subpart A]		City of Denver
Training Special Provision – Approval of New Project Training Programs (Note: this action cannot be assumed by State) [23 CFR 230.111(d), (e)]		FHWA
FOOTNOTES:		

(1) City of Denver is responsible for ensuring that all individual elements of the project are eligible. FHWA will check that the scope of the project as described in submitted project agreement is eligible for the category of funding sought. All final eligibility and participation determinations are retained by FHWA.

(2) If there is a 23 U.S.C. 326 or 327 assignment or PCE agreement, decisions are handled in accordance with those assignments or agreements.

(3) Modifications to, or variations of this agreement require a written agreement between the City

PROJECT ACTION RESPONSIBILITY MATRIX	
ACTION	**Agency to Approve/Concur**
and County of Denver Project Manager and the FHWA CO DIV Project Manager, in accordance with City and County of Denver amendment procedures. (4) Approvals and Concurrences of line items in this agreement can be submitted directly to the Agreement Officer Representative (AOR) and the CO DIV Project Manager.	

Contract Control Number:

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals at Denver, Colorado as of

SEAL

CITY AND COUNTY OF DENVER

ATTEST:

By_____

_____

APPROVED AS TO FORM:

REGISTERED AND COUNTERSIGNED:

By_____

By_____

By_____

Contract Control Number:

By: _____

Name: _____
(please print)

Title: _____
(please print)

ATTEST: [if required]

By: _____

Name: _____
(please print)

Title: _____
(please print)