APPENDIX B: PROJECT SCENARIOS

The Project Scenarios are representative of the type of work to be performed on Denver Smart City projects. By submitting responses to scenarios, your firm is allowing the city to accurately compare knowledge, quality, and approach.

These are for evaluation purposes only and are fictitious in nature; vendor responses will not be used outside of the evaluation.

<table>
<thead>
<tr>
<th>ICT SCENARIOS</th>
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<tr>
<td><strong>ICT-1: Systems Engineering</strong></td>
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**Scenario**
Denver Smart City has a network that is IPv4 but is looking to implement a portion or element of IPv6. This IPv6 element will provide interoperability between various IOT sensors, Connected Vehicle Security Credential Management System (SCMS) and the City & County of Denver network. The solution must conform to the RFC8200 IPv6 standard and will include networking products and services and security guidelines. Technical staff from Public Works and Technology Services need to review and approve the solution.

**Components of Response**
What approach would your firm take for this bridge between IPv4 and IPv6? What technical hurdles would your firm expect to come across, and what would you suggest, based on your firm’s previous experience, should be done to overcome these potential hurdles? What additional tools would your firm use? Please include how long it would take your firm to produce a design have it signed off on to move to production.

| ICT-2: IoT Data Development |

**Scenario**
The Denver Smart City Team is working together and with strategic partners to analyze: weather, transportation, air quality data, and Denver neighborhood data including demographic and economic development information.

**Components of Response**
Your firm has two deliverables:

1. Produce a reusable neighborhood model including data input, documented algorithms and data outputs utilizing Microsoft Azure. The model should include a visual dashboard that provides an analysis of the data.
2. Produce a RESTful Public API in JSON format that will provide external entities the ability to receive the data identified above in an industry standard format including the following parameters:

- Starting Date (Month, Day, Year)
- Ending Date (Month, Day, Year)
- Data Type (transportation, demographic, air quality, demographic, all)
- Neighborhood (Denver)

Technical and strategic staff from Public Works, Technology Services and Human Services would need to review and approve the proposed solution. What type of architecture artifacts would you create? What additional tools would you use? How would you establish developer and production instances of the environment, and what policies would you put in place to govern those instances?

Please provide example code for the two (2) deliverables. Please propose a timeframe, project methodology including key milestones, and possible risks to this effort.

ICT-3: IoT Software Development

Scenario
The Denver Smart City Team is looking for lean, agile-ready software development teams to assist with developing an IoT-specific software solution. The team is looking to build an application on Linux-based IoT hardware module running the USDOT-sponsored open source V2I Hub software. Denver has allocated budget and time for eight (8) two-week sprints to support this development. Denver requires that this development be conducted in the open, using open source friendly licensing, and is published to a common repository for community use and upkeep at the conclusion of the project.

Components of Response
What would be your firm’s approach and methodology in general? What considerations should the team- internal and external- take based on your firm’s past experience using open source code? Please include specifics related to reviewing and accepting external pull requests and programming and developing for IoT/ITS hardware devices. What do you see as risks to the effort?

ICT-4: Azure Managed Services

Scenario
The Denver Smart City Team is looking for Azure administration to provide support on a Microsoft Azure Commercial instance that processes data at rest and data in motion. This firm manages the Azure environments for both non-production and production environments, user account management, and implement an integration model between both environments.

Components of Response
What team would you put together from your firm to ensure Azure is administered appropriately? What methodology would you use? What additional tools would you use? Within a 12-month
timetable, please include what services would you provide within this timeframe, certifications, job titles, and possible risks to this effort.

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<tr>
<th>ICT-5: Azure Platform Development</th>
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<tr>
<td><strong>Scenario</strong></td>
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<tr>
<td>The Denver Smart City Team is looking for Azure platform development resources to provide services on a Microsoft Azure Commercial instance that utilizes applications, data, and interfaces for Denver Smart City Services.</td>
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<td><strong>Components of Response</strong></td>
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<tr>
<td>What team would you put together from your firm to ensure Azure platform development meets the City business needs? What methodology would you use? What additional tools would you use? Within a 12-month timetable, please include what services would you provide within this timeframe, project methodology including key milestones, job titles, costs and possible risks to this effort.</td>
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<th>ICT-6: Travel Time and Reliability</th>
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<td><strong>Scenario</strong></td>
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<td>The Denver Smart City team is looking for a firm to provide data collected by field sensors to a public-facing API. The City has a sensor for travel time and reliability at every intersection along Colorado Boulevard that it would like to provide as a public data stream for third parties, including application developers.</td>
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<td><strong>Components of Response</strong></td>
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<td>What would you approach be to scope and implement this project, including ingesting and processing the data, provide the data to third parties in a manner that allows them to query the data, user acceptance testing, and establishing a rollout plan for stakeholders? Please describe the team you would put together to complete this project. What milestones would you put in place for this project? What risks should the stakeholders anticipate, and how would you mitigate them?</td>
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## ITS SCENARIOS

### ITS-1: Technology Integration Management

**Scenario**
The Denver Smart City team is looking to install a large number of connected vehicle on-board devices (OBUs) to provide dedicated short-range communications (DSRC) connectivity to other vehicles and infrastructure. Your firm is asked to be the prime technical and installation lead for the vehicles, to include working with multiple OBU vendors and different types of City fleet vehicles. In addition, you’re tasked with determining the best approach for integrating the OBU into the vehicle’s data bus for additional vehicle signals like airbag status, brake status, etc. Finally, the installation of these devices must not interfere with any other functionality of the vehicles, including other accessories such as emergency signal lights, telematics devices, or heavy-duty equipment.

**Components of Response**
How would you/your firm approach this project? How would you verify that your proposed solution will work for the city? On your first day working on a task like this, what would your first three questions to the project manager be? How would you handle a situation where- mid-way through this project- another technology was introduced that also must be incorporated into the fleet vehicles data bus?

### ITS-2: ITS Project Metrics

**Scenario**
The Denver Smart City Team has developed a scope of work for a smart city technology project along Colorado Boulevard with the goal of reducing congestion. The technology makes small changes in the signal timing based on data from a subset of vehicles on the roadway. The project plan currently lacks a methodology for evaluating the impact of the project. The team needs to establish early goals for the expected impacts from the project and develop methodologies to measure those impacts. You are tasked to lead the evaluation phase of this project.

**Components of Response**
What would be your approach to setting up goals from an ITS perspective? What baseline metrics would you set up to measure the outcomes of a project like this? When the team reaches the evaluation stage, what statistical techniques would you deploy to measure the impact of the interventions? What skillsets are necessary to effectively analyze and evaluate the resulting data? What are some lessons-learned from your firm’s previous experience?
ITS-3: ITS Design

Scenario
The Denver Smart City Team is planning an ITS project along Colorado Boulevard with IoT and ITS devices, with one ITS device per intersection. The team is looking for support on the Design phase of this project, to include evaluating wiring, poles, and conduit. The delivered design should create a standard for deployment at each intersection along Colorado Boulevard, and have reusable specifications. This implementation is a non-construction technology deployment.

Components of Response
How would you approach this scenario? How much time should be allocated to this phase of the project? What special considerations you would take to ensure the technology being deployed meets the city’s expectations?

ITS-4: ITS Deployment

Scenario
The Denver Smart City team is ready to deploy the entire corridor of Colorado Boulevard with IoT and ITS devices on traffic signal infrastructure. A design for the deployment is already complete. The effort involves developing a specific scope and delivery schedule, evaluating each intersection for deployment readiness, providing appropriate staff, vehicles, and equipment needed to conduct the deployments, and ensuring the completed system is working as intended. The deployments will require close coordination with the engineers and technicians.

Components of Response
How much time should this phase of the project take? What would you take inventory of or investigate before beginning this deployment? Please describe any lessons learned or identify potential risks for this effort from scope, schedule or other perspectives from your previous industry experience. Please describe what special considerations you would take to ensure the technology being deployed meets the city’s expectations.

ITS-5: Freight planning

Scenario
The Denver Smart City team is looking for assistance strategically engaging freight companies throughout the lifecycle of a two-year project. The project will involve equipping dozens of freight vehicles from multiple companies and 100 intersections with technology to improve freight vehicle travel time. At the outset, the Denver Smart City team needs to develop a strategy for engagement with the companies, conduct initial outreach, and begin collaborative planning on a project deployment which will include route selection, testing of the technology of freight vehicles, and sharing program-related data.
**Components of Response**
What timeline would you propose for the initial planning steps? What are potential hurdles with equipping private freight vehicles with public sector funding and devices? What are some risks to success from people, process, and technology perspectives? What could be some metrics for success of this specific effort?

**ITS-6: Interface Designer**

**Scenario**
The Denver Smart City Team is implementing a project that displays new information to snow plow drivers in the cab of their vehicle during operations in the winter months. The display needs to communicate information about how long the driver will have a green light for the intersection they are approaching, and if they will make it through the intersection at their current speed. Your firm is tasked with designing and developing the interface for the driver. Denver has allocated enough budget and time for two, two-week discovery sprints, and four two-week development cycles.

**Components of Response**
Describe the process you would use to establish the design. How would you test the effectiveness of the design? What constraints would you anticipate starting on this work? What are elements and lessons learned from a prior project that required a similar approach to this?

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**BI SCENARIOS**

**BI-1: Strategic planning:**

**Scenario**
A year and a half ago, Denver Smart City was formed and began tactically, building on current efforts in functional areas, such as connected vehicle and electrification efforts. This allowed the team to understand the market and possibilities from a municipal perspective, which is of paramount importance in an emerging industry. This approach was built on the foundation and great work of previous efforts such as Blueprint Denver, the Mobility Action Plan and the 2020 Climate Action plan. The primary departments focused on currently-funded efforts are Public Works, Technology Services, Public Health & Environment, the Mayor's Office. Another department in Denver wants to work on a specific new effort in the smart city space.

**Components of Response**
Please describe your approach to evaluating if and how this department should be engaged. Based on your firm’s understanding of smart cities best practices nationally or globally, please choose a
department and use case based on a department that should be engaged and/or an outcome that Denver Smart City should be working on. Create a case for why this department and effort needs to be included in Denver Smart City, as if you are working with engaged staff of the current implementation team, to present to the Executive Steering Committee, which is made up of an appointee from each department listed above.

**BI-2: Public engagement:**

**Scenario**
Part of a project’s deployment is around putting out new equipment around highly utilized pedestrian crossings. An intersection that is adjacent to a school in an underrepresented area of Denver has high traffic volumes. Your firm is tasked with developing a public outreach plan to bring the community into the process and generate excitement about a proposed solution. The outreach would occur over a 2-month period, deployment over two weeks and the new equipment will be out for at least a month.

**Components of Response**
Please explain your approach, including what you would do within this timeframe, key personnel and the hours they would be utilized. Please explain anything innovative you would do. What do you see as a big risk to the effort?

**BI-3: Electrification planning:**

**Scenario**
Many people talk about realizing the benefits of a “smart city” need to include electrification. Your firm is tasked to help the team to develop a two-year strategic plan.

**Components of Response**
What is your approach? Who should be involved from the private sector and in what manner? What are the questions the city should be asking itself? How should the City think about truly addressing equity disparities in the electrification space? How could your firm assure the plan is both aspirational and reasonable in terms of being able to implement?

**BI-4: Social and Behavioral Science:**

**Scenario**
The Denver Smart City Team is trying to determine how to influence the behavior of parents idling their vehicles near schools while waiting to pick up their children, so that they turn off their vehicles and reduce local emissions. The city has access to hyper-local data on the air quality surrounding the specific school that the parents are traveling to.

**Components of Response**
What steps would you take to formulate a recommendation to the City and school district to influence parent behavior? Please provide an example of an intervention in another community that has worked in a situation like this example describes? What metrics would you use to determine success? If we are not meeting the metrics for success after implementation, how would you determine the cause and what possible next steps would you suggest?

BI- 5: Technical Writing:

Scenario
This is one view of our connected ecosystem (see graphic). There is an opportunity to publish this ecosystem in a nationally-known technical journal that prefers words to graphics. Please turn this graphic into a technical document. Feel free/take liberties to add information based on fact or inference to represent the graphic with words only. The documentation could include examples of knowledge transfer, quality assurance testing, and traceability requirements. The document must meet all federal reporting requirements, including 508 compliances.

Components of Response
In addition to providing example documentation describing the graphic below, please provide a caption for this image that is 508 compliant in the HTML format. Please list examples of the types of documents your firm has produced in the past including documentation and reports that were subsequently used by a federal agency.
BI-6: Graphic design & Communication

Scenario
This is one view of our connected ecosystem (see graphic). There is an opportunity to talk with a community-oriented resident of Denver who wants to understand what we are doing and happens to both use a cane and is transit dependent.

Components of Response
How would you represent/visualize this ecosystem differently? Please use this space to visualize this for us-feel free to add or subtract information based on the specific person above and your knowledge of smart city concepts in general. Please annotate why you made the changes you did.

DENVER SMART CITY CONNECTED ECOSYSTEM 2018

- CONTROLLER: Traffic signal controller transfers information on the signal phase and the amount of time remaining until the light changes to the RSU which then broadcasts that data to the vehicle.
- DARNE: Denver Area Fiber Network Ecosystem communicates information between the TMC and the controller.
- DETECTION: Nidar, Lidar, Video will know when a pedestrian is both waiting to cross and crossing the intersection; alert to communicate information to the controller and vehicles.
- EDM: The Enterprise Data Management system collects data from multiple sources to develop a holistic, historic view of the ecosystem delivering analytics and insights to the TMC operator.
- ES: The Environmental Sensor will provide real-time, hyper-localized air quality information.
- OBU: Onboard Equipment receives data from the RSU radio and displays an appropriate alert to the driver.
- RSU: A Road-Side Unit transmits data to the vehicle.
- TMC: The Traffic Management Center is central operations for the system collecting data from the field and receiving historic data and insights from the EDM.
In looking at the scenarios, your firm believes the Denver Smart City team missed something and you are interested in the Niche/Innovative class - this scenario should be filled out by your firm in the class as the only scenario to which your firm responds.

Note: This Scenario is not available for Response in any other competition pool.

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<tr>
<th>OPTIONAL ADDITIONAL SCENARIO</th>
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<tr>
<td><strong>OPT-1: Missed opportunity by Denver Smart City Team</strong></td>
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**Scenario**
Denver Smart City is putting together a smart city showcase in the heart of downtown. All of the equipment has been selected in the connected vehicle, electrification and air quality areas. In the smart city space, you see that your firm performs key services to ensure the successful delivery of a project, either in the integration component or some other aspect; however, **NONE** of the scenarios fit your firms impressive and extensive expertise.

**Components of Response**
With the Denver Smart City Showcase, please describe any specifics of your services, what opportunities your service will afford the showcase and what risks Denver Smart City will inadvertently take on in the future without your service(s). Please clearly state how your services give us knowledge, information, flexibility, or choice relating to our connected ecosystem if applicable.

- **Local control of data**
  Maintain local control of City and County of Denver data sets since this is an emerging industry and the future is not known.

- **Default to Open Source**
  Leverage open source community innovation to create a system of systems, learning and gaining insights from each other.

- **Standards-based**
  Conform to established federal standards and emerging smart transportation industry standards, enabling the opportunity for interoperability.

- **Interoperability**
  Denver works to design architecture to support multi-vendor interoperability to bring in many solutions that fit together as a whole. True collaboration and - between the public and private entities- will improve outcomes key to Denver’s success.