

Connected Transportation Innovation Platform – Spokane, WA

Part I - Vision Narrative

1) Primary Vision

Spokane is a place where miraculous feats of ingenuity have repeatedly created urban innovations that have durably transformed our community, stimulated our economy and further increased the quality of life for our citizens. Spokane has aligned behind the continuity of leadership making Spokane a safer, stronger, smarter city of choice. The building blocks are in place, the partnerships are formed and the vision is clear.

Spokane proposes a transportation innovation proving ground where, in different measures, all twelve of the US Department of Transportation's Beyond Traffic vision elements will be addressed in a unique environment for mobilizing new concepts by researching and analyzing integrated models, testing and refining outcomes and producing prototypes for scaling to larger, more complex urban environments. Spokane proposes a building and testing platform which enables cities with complex transportation issues to capitalize on existing assets and grow in a manner that prevents the pervasive critical issues facing cities while achieving the primary aspiration to achieve an increasingly livable community. The opportunity to demonstrate outcomes in Spokane is relevant to all American cities where we must capitalize on our existing assets as we make new investments, taking care to avoid negative unintended consequences.

Our objective is to combine smart city solutions at manageable scale to create measurable impact while reducing costs associated with both deployment and operations - and in a way that is always people-centered. The ultimate goal is to make more vibrant, healthy and productive communities. Rather than pursuing a singular solution, we take an overall systems approach focusing on the opportunities of multidimensional change that will unlock the potential of our city's existing assets. We concentrate on a leveraging the emerging rich data environment for managing existing resources, thus acknowledging the immense infrastructure that exists in the legacy of our industrial cities. We recognize that adoption of the very best, most cutting edge transportation technologies will fail if there is not thoughtful consideration given to the infrastructure of our existing cities as well as the equally pressing challenges of equity, inclusivity, and reduction of disparities in how people experience their city.

Spokane's Smart City Challenge proposal holds electrification of the transportation sector as its initial leverage point, but additionally embraces the people, policy and regulatory factors that holistically shape the modern urban landscape. Our holistic approach aims to empower cities to leverage their existing infrastructure and data assets with the infrastructure and data assets of others to achieve the best possible outcomes for current and future residents.

Social science outcomes will be documented and studied equally with "engineering" outcomes in Spokane. The outcomes of each vision element implementation will be meticulously documented and published as Spokane's proving ground is designed in close collaboration with, and as a magnet for, principal

investigators practicing in the multiple higher education institutions, hospitals, health district, non-profit and private industry partners. This research environment is already contributing to the multi-faceted discourse related to intelligent cities everywhere and the vanguard of new transportation technologies.

Our integrated, community-wide approach will demonstrate that transportation decisions not only impact how we move in cities, rather how those transportation decisions shape what type of city we get to move in. We believe our approach will elevate the topic of transportation in relation to urban form as well as encourage a broader realization that how we shape our cities has a direct impact on how they shape us.

Why Spokane?

Spokane is a uniquely positioned mid-sized city for the proposed proving ground. Isolated from the influences of adjacent large urban areas and serving as the regional center for medical, banking, transportation/logistics, manufacturing, education and culture for an Inland Northwest geography serving more than 2 million people. Spokane is representative of the population shift from rural to urban areas defining many American cities. A trend that will surely increase in the coming decades. This movement will both elevate the problems and the promise of "our cities". This is a local and global reality. Our system approach is thus considerate of the compounding importance of addressing the pending sociological, geographic, environmental, and public health issues, as well as transportation issues of our increasing urbanization. Our historically unprecedented migration to cities is expected to intensify during the next few decades, requiring leading practices that can shape our rapidly transforming urban fabric, let alone respond to our current (transportation) challenges.

Spokane's culture is balanced by a healthy tension between progressive and conservative politics, an urban culture and a farmer's work ethic. Our city is the result of and our community is characterized by a pioneer spirit exemplified by neighbor-helping-neighbor and a deep and generous compassion for one another. In the business culture arena, Spokane enjoys a well-educated, hard-working workforce and a fiscally responsible track record that makes the most capital efficient investments and understands how to bootstrap grand initiatives. The Smart City Challenge proposal we offer bears out these values. The US Department of Transportation and Vulcan Foundation dollars invested in Spokane will go farther toward the goals of Beyond Traffic 2045 than possible in any other mid-sized city.

Our history demonstrates the unique ways that we have succeeded locally and at a global scale.

In 1974, for example, with tenacious, visionary leadership and heroic public and private collaboration, Spokane became the smallest city ever to host a World's Fair. On a global stage, Spokane was the first city ever to host a World's Fair with an environmental theme. In many ways economically, physically and culturally this event shaped the modern destiny of Spokane. Next a local 1976 Olympics marathon runner capitalized on the revitalization by organizing what has become known as Bloomsday. In just under six months, the first event was conceived, organized, financed and presented by volunteers with over 1000 runners participating. The event quickly grew to become the largest timed road race in the world peaking at 61,000 finishers and consistently reporting over 40,000 finishers every year. The event is still run by volunteers and was one of the first to employ RFID timing chips in 2006. From our hosting of consecutive Winston West NASCAR road races thorough the Downtown Spokane Core (100 laps of a 1.65 mile course) during the July 4th weekends in 1987-88 to the world's largest 3-on-3 basketball tournament with more than 27,000 participants, 7,000 teams, 450 courts spanning 40-plus downtown city blocks and attracting a crowd

of over 250,000 every year. Spokane is the place where we do the unexpected, the difficult to achieve. We are able to think big, start small and move fast.

Moreover, our community has always been able to coalesce behind leaders demonstrating the community's interests and has been convincing in attracting outside investment by honing a shared vision, teaming up to accomplish more and by speaking with a unified voice. In the 1990s, community leaders came together under the banner of "Momentum" to rejuvenate the regional economy. They saved Spokane's economy and preserved a vibrant downtown core during a time when many downtown cores were being abandoned as retailers and consumers flocked to suburban malls.

Twelve years ago, more than 350 members of the community established a shared vision and created a master plan to revitalize a 770 acre plot of land that once hosted a rail yard and municipal waste disposal. The property, along the Spokane River and adjacent to our downtown core, has been transformed into Spokane's University District -- home to six higher-education institutions.

Now, Washington State University Spokane is establishing the first new public medical school in Washington since 1917 with an historic broad base of support as they are addressing the critical shortage of primary care physicians in Washington and nationally. New students are scheduled to be admitted fall of 2017 and the effort complements the fact that life sciences and services comprise nearly 40% of the regional economy. Spokane currently has the fastest growing health sciences campus in North America.

Spokane has all the building blocks for creating a robust medical education and research center including our state's two largest public universities committed to expanding in Spokane - WSU Spokane's health sciences and research focused campus with plans underway to create an independently accredited four-year medical school and the expansion of the existing Spokane-based University of Washington School of Medicine's WWAMI four-year medical school program that ranks #1 in primary care and rural education. Building on the collaborative system of strong health sciences and allied health programs of our regional universities and community colleges with the nationally-recognized, regional-community based healthcare system, the foundation is set for continuing to engage business and community leadership in the advocacy and support of the expansion of world-class medical education and other health sciences careers in Spokane.

Residents of the region live and work as partners at the intersection of urban and rural; land and water; all modes of transportation; as well as manufacturing, service and knowledge economies working together. Success for Spokane's Connected Transportation Innovation Platform submitted to the US DOT Smart City Challenge comes from taking advantage of these connections and unique assets as a regional center to build a smart + connected, healthy, mobile and sustainable future.

Few regions offer Spokane's combination of focused strengths in high-demand sectors — healthcare-biosciences, aerospace, clean technology, energy efficiency, IT and digital services — with the unparalleled quality of life it takes to grow and retain a talented workforce and productive businesses for the long term.

Environment

- Diverse land uses ranging from urban centers to local food production to wild and scenic recreation - all in close proximity
- A river running through the heart of downtown Spokane and the region that brings power, beauty, and clean drinking water through its interconnection with our unique sole-source aquifer

Economy

- Health care, higher education, and government sectors as stabilizers in changing times
- Supportive networks and services for entrepreneurs and innovators willing to take a chance on an idea
- Opportunities to link all sectors and modes of transportation for movement of people and goods in and through the region

Community

- Commitment to collaborative approaches that leverage the distinctive strengths of each partner and create a whole greater than the sum of its parts
- Belief in the power of education to align with and support the needs of business and society to improve opportunity and outcomes for everyone by educating, retaining and investing in our workforce
- Dedication to the cultivation of an inclusive community spirit that welcomes people bringing all varieties of the human experience to build our region together

Measurement of success as a community includes evaluation of how citizens, businesses and institutions work together to create opportunity for an education, a living-wage career, a secure economic climate, and an affordable, healthy lifestyle without compromising quality and opportunities for future citizens.

So, it's only natural that we tap into this legacy and this collaborative spirit as we pursue our vision of a Smart City proving ground in Spokane.

Spokane University District Smart City Accelerator

Cross-sector collaborators in Spokane have been developing the Spokane Smart City Accelerator for nearly two years. The unique collaboration of the City of Spokane, Avista Utilities, Itron, Washington State University, the University District Development Association and McKinstry describes the accelerator as follows:

The Spokane Smart City Accelerator is a living laboratory to design cities for the future. Located in the University District, we harness data to gain insights, empower people and solve urban challenges in new ways. We enable:

- **healthier** citizens
- **safer** neighborhoods
- **smarter** infrastructure
- more **sustainable** environment
- **stronger** economy

The Smart City Accelerator stands out from other smart city initiatives in its ambition to establish a technology proving ground which is geographically bounded in the 770 acres of Spokane's University District and that is a standards-based, open architecture, open data and open analytics platform for innovation.

With funding from the US DOT Smart City Challenge Spokane will apply these principles across the transportation sector with primary emphasis on multi-mode mobility, transit and transportation electrification.

In December of 2015, Spokane was selected to be among the first 10 cities in America to participate in a program sponsored by Envision America. As part of the selection, Spokane joins 9 other cities in a yearlong support effort preceded by an intensive workshop which was held in January, 2016. Spokane is being recognized for its efforts in becoming a safer, stronger and smarter city. Formation of Envision America, a national nonprofit, was announced in September of this year during a White House event in which the Administration announced a new "Smart Cities" Initiative to help communities tackle local challenges and improve city services. Envision America, focuses on challenging America's cities to become smarter by accelerating deployment of innovative technologies. This opportunity has engaged a number of industry and public sector partners in mentoring Spokane's success in further developing its connected innovation platform.

The proposed approach will use advanced data and intelligent transportation systems and applications in a balanced and diversified approach to reduce congestion, improve safety, respond to climate change, connect underserved communities, and support economic vitality.

Local Challenges Lead to Translational Solutions

Spokane is focusing on improving its most integrated and impactful economic performance indicators. The economic dimensions of our community are the primary levers for improving our outcomes. Median household income is increasing at a rate faster than any other community in the State of Washington. This trend must continue. Additionally Spokane will continue its efforts to continuously improve the quality and condition of the Spokane River. The project initiatives funded by this proposal clearly support Spokane's aspirations.

The Connected Transportation Innovation Platform and the goals and objectives of Spokane's University District are central to catalyzing our signature collaborative approach to these local challenges. Public, private and non-profit entities are unified in their approach to the issues mentioned above and those listed below.

Spokane Challenges –

- Improve median household income, create jobs, continue to support and attract entrepreneurship
- Attract development activity and infill
- Improve housing and its affordability, in part, by improving walkability in all neighborhoods with an emphasis on affordable housing
- Address funding for maintenance of existing infrastructure
- Continued accelerated water quality improvements for Spokane River
- Improve pedestrian and bike safety
- Reduce socio-economic disparities – continue to work for collective impact
- Add additional mobility options to North Spokane freeway corridor to avoid over-capacity before it can be fully funded and built
- Real time data to reroute motorists and freight/delivery vehicles due to high number of at-grade rail crossings
- Improve visitor appeal/convenience
- Address concerns about oil/coal transport through Spokane
- Increasing I-90 congestion between Spokane and Coeur d'Alene

Intended Outcomes

The award made in this grant will shift the adoption curve of transportation electrification (transit, commercial, private) by orders of magnitude as well as significantly accelerate the well-developed plans to establish Spokane's University District as a smart city proving ground resulting in the following benefits from the demonstration project completed during the period of performance:

- a) Substantially higher penetration rate of personal electric vehicles and electric vehicles of all types
- b) Electrification of a significant segment of the regional transit fleet (emphasis on accelerating the Central City Line - high performance transit and other major fixed routes serving the Downtown core.)
- c) Electric vehicle charging infrastructure in sufficient density and type to enable all transportation modes access to convenient charging network and reducing barriers to adoption.
- d) Ability to work out regulatory and licensing hurdles at community-scale
- e) Demonstrate the economic value proposition for a wide spectrum of the consumer market for cleaner transit and transportation.
- f) Demonstrate the integration of all modes of transportation with the University District as the focal point and provide feedback regarding the health impacts of each mode in the mix so that people can make individual and informed mode choices.
- g) Measurable reductions in greenhouse gas emissions during the grant period of performance
- h) Shifting the trajectory of the adoption curve in a geographically isolated urban area such as Spokane is easier to implement and easier to measure than other more complex urban areas.
- i) Opportunity to track migration from rural to urban population trends and the impacts that advanced transportation options impart on the urban migration trends as well as public health outcomes.
- j) Fully develops and supplements the already-planned smart city technology accelerator in the University District
- k) Accelerates the density of sensor networks, communications infrastructure and data sharing hurdles are already being addressed.
- l) Demonstrate technology-assisted freight and delivery options. Incentivize adoption of EV deliveries.
- m) Integrated parking strategy and shared vehicles integration will be demonstrated. Every aspect of how parking can shape the community and the transportation choices people make will be examined and will be the subject of multiple academic investigations.
- n) Pedestrian and bicycle infrastructure will be improved in conjunction with the high performance transit and University District improvements funded by the grant proceeds. ITS applications in the University District are intended to focus first on the pedestrian and cyclist rather than the motor vehicles. Machine learning techniques will be applied.
- o) The sensor network planned for the University District will be designed to achieve healthier people, safer neighborhoods, smarter infrastructure, a more sustainable environment and a stronger economy. Together these characteristics substantially define a vibrant resilient city of choice.
- p) Leverage the 80% reduction in greenhouse gas emissions that result from driving electric vehicles powered by the mix of hydropower and other clean electric power sources available in Spokane, compared to driving a gasoline-fueled vehicle, at less than \$1 per gallon equivalent.

Given that Spokane and the Inland Northwest in general currently has a relatively low EV adoption rate, the scaled-up and accelerated EVSE project will demonstrate to what degree strong utility involvement in partnership with the community can stimulate higher EV adoption rates – a key question yet to be conclusively demonstrated anywhere in the nation, with important ramifications as a model for other utilities and cities both large and small

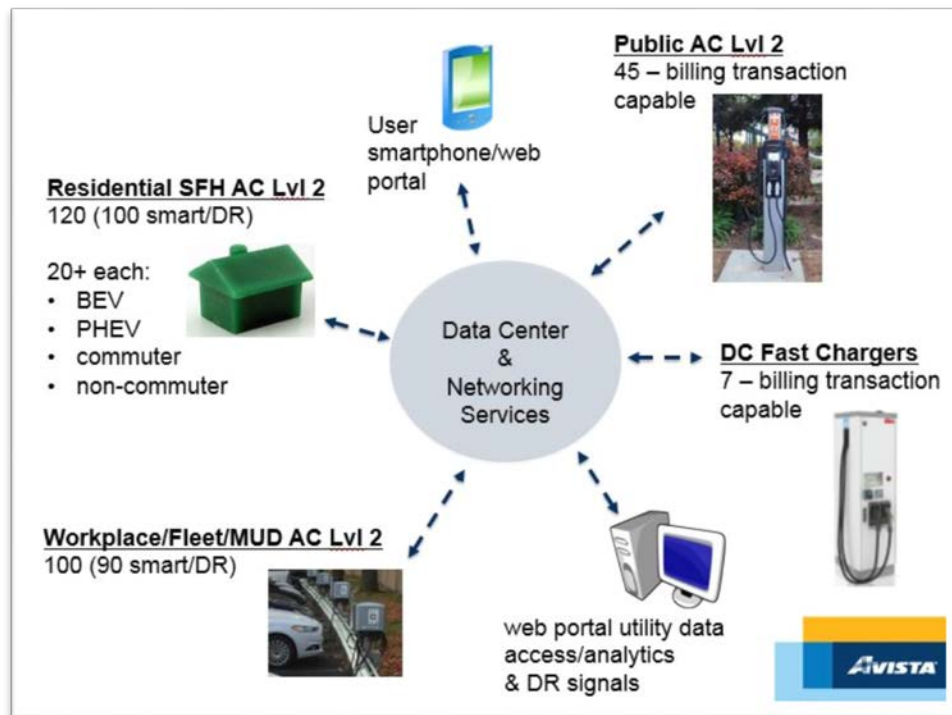
Specifically, the initiatives supported by the US Department of Transportation Smart City Challenge in Spokane are summarized as follows:

1. Accelerate Electric Vehicle Supply Equipment in Urban Core

Avista Utilities has filed a pilot plan with the Washington Utilities and Transportation Commission to install AC Level 2 Electric Vehicle Supply Equipment (EVSE) at the following locations: 120 residential single-family homes (SFH), 100 at workplaces, fleet and multi-unit dwelling (MUD) locations, and at 45 public locations. In addition to the AC Level 2 EVSE installations, Avista is proposing to install DC Fast Charging EVSE at seven locations as part of the pilot program enabling regional travel with electric vehicles (EV) and addressing a key barrier to EV adoption.

All Level 2 installations will be completed at sites that are customers of Avista. Of the AC Level 2 EVSE installations, “smartchargers” will be planned for installation in 100 residential and 90 other locations. Smartchargers provide enhanced capabilities that allow for data acquisition, network communication, and demand response, which is essential to determine baseline charging profiles, enable demand response experiments, and ultimately help shape the long term impact of EV charging for the greatest benefit of all customers.

The illustration below shows how the various installations, network services and interfaces relate to each other in the proposed pilot.



In addition to stimulating greater EV adoption rates, this pilot program will enable a comprehensive, integrated understanding of EV charging at home, at work and in public areas – what is needed, what is effective, and how it may affect the grid in the future. It will further demonstrate the economic and environmental benefits that may be achieved with a transition to electric transportation – leveraging the 80% reduction in greenhouse gas emissions that result from driving electric vehicles powered by the mix of hydropower and other relatively clean electric power sources available in our area, compared to driving a gasoline-fueled vehicle, at less than \$1 per gallon equivalent. Given that Spokane and the Inland Northwest in general currently has a relatively low EV adoption rate, the EVSE pilot will demonstrate to what degree strong utility involvement in partnership with the community can stimulate higher EV adoption rates – a key question yet to be conclusively demonstrated anywhere in the nation, with important ramifications as a model for other utilities and cities both large and small. Another important finding from this pilot will be to show to what degree EV charging may be accomplished during periods of low system demand for electricity (“off-peak” charging), administered by the utility, while maintaining high customer satisfaction. This will show how utility grid assets may be more highly utilized, thereby minimizing costs and capacity investments to handle increased peak loads that would otherwise result in increased greenhouse gas emissions. In sum, the pilot will provide an immediate stimulus to higher EV adoption rates, and position the utility and policymakers to make informed long-term decisions that maximize benefits for all community members in the years ahead.

With additional funding from the USDOT Smart City Challenge, Avista will quadruple the number of AC Level 2 installed in workplace, fleet, and multiple-unit dwelling (MUD) locations, and double the number of public AC Level 2 and DC fast charging installations, thereby supporting an accelerated EV adoption rate. Workplace charging in particular has been shown to be a highly effective catalyst for higher EV adoption, and therefore will play a central role in an expanded program (US Department of Energy Workplace

Charging Challenge Progress Update 2014,

http://energy.gov/sites/prod/files/2015/11/f27/WPCC_2014progressupdate_1114.pdf)

Funds will also be utilized to greatly increase the level of outreach and education programs, including those to stimulate commercial electric fleets and the formation of an electric EV loaner and ridesharing fleet for participants in the program, and in partnership with other organizations to enable economical EV driving by low income members of the community.

2. Significantly Accelerate Electrification of Transit System

Present plans for migrating the Spokane Transit Authority fixed-route bus fleet to electric following normal capital equipment replacement schedules have full conversion system-wide by 2031. Under this proposal, it is planned that the Central City Line high performance transit route and other major fixed routes serving the University District will be converted during the performance period.

3. Augment the Transit System Serving the University District

We have an existing coordination of private and public leadership poised to make our University District the most advanced transit oriented neighborhood in the Pacific Northwest. This includes mobility on demand (MOD) and shared-use options (bikes, cars, scooters) as defined by extensive survey of residents' stated needs and research/pilot outcomes from other cities. Implement all manners and forms of programs and rate structures that reduce or eliminate barriers to use. We will expand the availability of the existing Universal Transit Access Pass (UTAP) program and integrate with MOD services and infrastructure. This will require advances in fare technology, distribution channels and a more open data architecture to allow for integration with other mobility providers, including public and private entities. Enhance and improve passenger waiting areas to incorporate additional traveler information that supports this advanced integration of mobility.

We have already made monumental strides in creating "people-first" urban condition. As part of the largest single transportation investment in state history, Spokane will soon realize a landmark pedestrian bridge expanding the ways to move in the city. Already, developers, city planners, and citizens are engaging the opportunities offered by increased mobility. Public response to current high performance transit proposals demonstrate that our community is enthusiastic about embracing future outside of the condition of single-occupancy cars.

4. Accelerate the Full Extent of the ICT/Data Functionality of the University District Smart City Technology Accelerator

Even though the strategy being implemented is comprised of building an open architecture, open data, open analytics platform with edge intelligence to be used for rapid prototyping and innovation; the effort is not manifested in the simply in the platform. Technology is a necessary enabler but Spokane's initiative goes far beyond technology to incent people to take control of the destiny of a city (or district) with goals, aspirations and its own unique fingerprint. Thus, the crucial step to create a digital master plan will be accelerated under the Connected Transportation Innovation Platform project. The digital master plan, among many other outcomes, will produce a functional governance model for the management of the data resource which also addresses data privacy as well as cyber security issues from inception and for the long haul. Due to the unique multi-jurisdiction, multi-stakeholder nature of the proposed data and analytics platform, there is a distinct need to collaboratively address planning for the digital future of the District. That need will be met. Additionally, the City will complete the establishment of citywide cyber security and open

data policies near the beginning of the period of performance. More information about the shared data and communications platform architecture can be found later in this proposal. See Data Integration.

5. University District Integrated Parking Strategy

The City of Spokane and The University District Development Association are already pursuing a *University District Integrated Parking and Urban Mobility Strategy* which focuses on the relationship between parking and urban form. The project will create a model that will inform and lead development in The University district toward new urban possibilities and mobility priorities. The project concentrates on an integrated parking strategy while incorporating broader transit, pedestrian and mobility interests. The goal is to optimize the role played by parking in both economic development and the mobility chain in The University District, thus impacting how we get around in our City as well as what type of city we are developing.

There are important synergies with the known smart city enablers and because the University District is the focal point of the Smart City Accelerator Initiative. So called, "smart parking" is where new technologies merge with parking systems. In addition to widely deployed technologies such as, credit card and Pay-by-cell functionality, future "smart" functionality to be installed in the University District will include real-time data and analytics, resulting in parking guidance technologies, user reservation systems, predictive enforcement and collections, more complex user considerations and more sustainable technology, design, and innovation possibilities. In conjunction with Spokane's proposed plans resulting from the Envision America challenge and award, the integrated parking strategy reflects the receptive environment for integrating new technology with policy innovations.

6. Generate and Test Complementary Connected Transportation Applications

We have a number of leading research and technology innovators from Itron, a global leader in over 100 countries specializing in device and control technology, data analysis and smart grid technology, to Tango, electric commuter cars, based in Spokane. Research projects range from smart city work by the Integrated Design Lab at Washington State University, focusing on a holistic approach for sustainability, to a team developing refueling stations for vehicles that run on hydrogen fuel-cell systems sponsored by the U.S Department of Energy and National Renewable Energy Laboratory. Our distinct capabilities in energy, education, and transportation leadership enable us to collaborate on the problem of transportation, focusing on solutions that are sustainable in the senses of social, environmental and climate impacts. Our local transportation thought leaders are very active at the state and national level working smart growth policies and landmark, light rail developments for example.

The multitude and diversity of research and demonstration projects proposed are connected through integrated design of the built environment. Like a digital platform that connects autonomous devices in smart environments, the physical infrastructure, buildings, and streetscapes in the 770 acre University District (polygon) and the 6 mile long Central City Line (spline) serve as a unifying platform for an infinite number of research project test-beds. The WSU Integrated Design Lab in Spokane specializes in stakeholder engagement and technical assistance to realize this coordination in the design of near-human and infrastructure scale projects.

2) Spokane Attributes - Population

Spokane City - 2010 population: 208,733 – 53.84% of the urbanized area, with a population density of 3,526 persons per square mile. The City of Spokane is 49% denser than the urbanized area in which it is situated.

As of 2010, there were 123,127 jobs within the City of Spokane. This represented 63.1% of all jobs within the Spokane urbanized area. (Source: OnTheMap.census.gov)

As of 2010, 18.7% of Spokane residents had incomes below the poverty level (Source: US Census Bureau, 2006-2010 ACS Survey 5-Year Estimate)

3) Spokane Attributes – Smart City

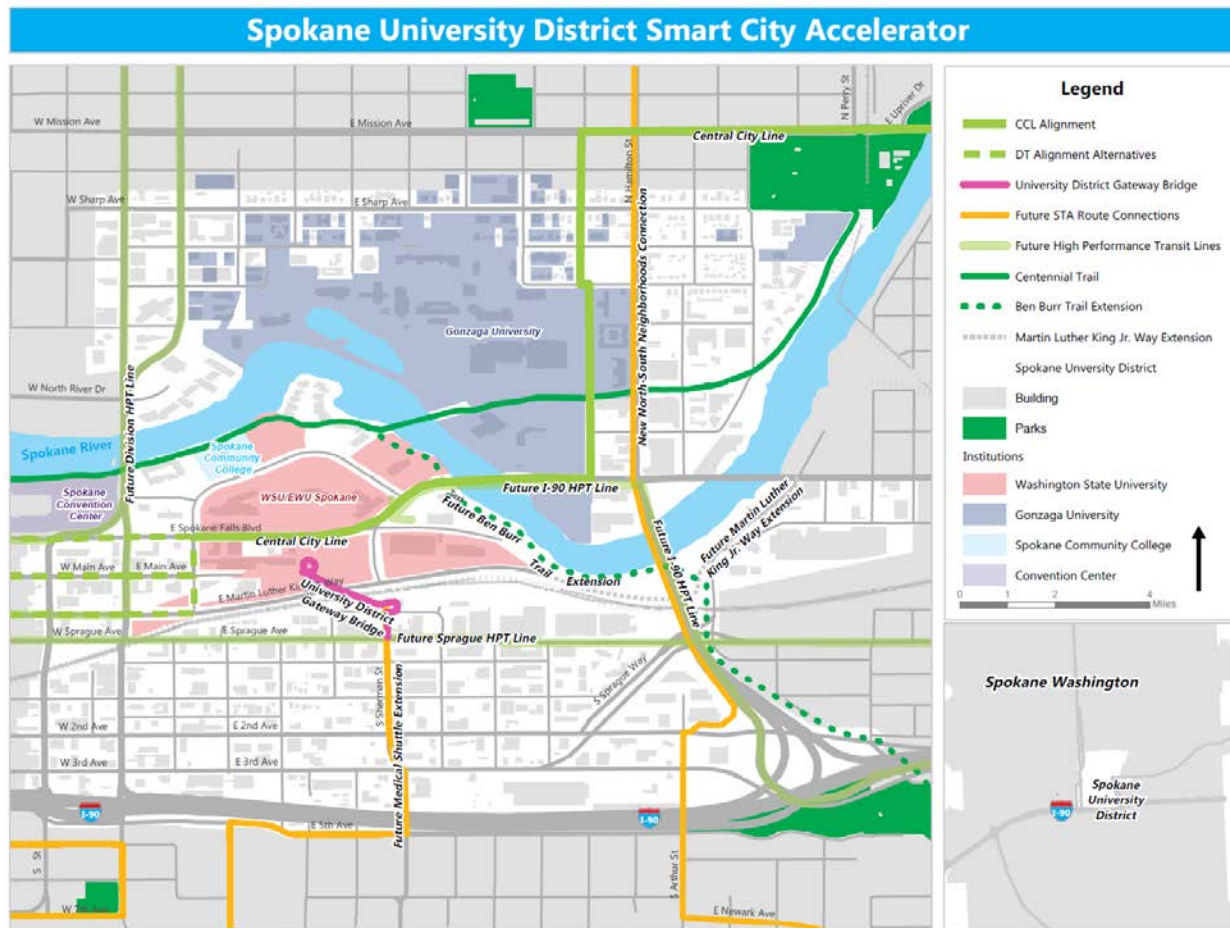
Spokane's ongoing commitment (two years) to establish a smart city proving ground in its University District is evidence of clear intentions to not only embrace, but to capitalize upon the principles in the USDOT Smart City Challenge.

Spokane Transit provides over 11 million annual passenger trips and travels over 6 million miles within its Public Transportation Benefit Area (PTBA) annually, serving the cities of Airway Heights, Cheney, Liberty Lake, Medical Lake, Millwood, Spokane, and Spokane Valley as well as parts of unincorporated Spokane County. The system includes 34, fixed routes, complementary Paratransit services and a robust vanpool program. There are over 1600 designated stops around the region. Currently there are seven fixed routes that directly serve the University District. There are four corridors in the district that are served with frequent (buses every 15 minutes) for 12 hours a day on weekdays.

In conjunction with Spokane's proposed plans resulting from the Envision America challenge and award, the integrated parking strategy reflects the receptive environment for integrating new technology with policy innovations.

A commitment to integrating with the sharing economy is inherent in the tight-knit fabric of all community stakeholders. We realize that smart cities empower their residents with information and we have a proven track record in creating partnerships and alliances to leverage and share creativity, expertise and insights. This long standing cooperation has a profound application as we liberate data and empower others to engage in the design of intelligent urban spaces that serve our unique attributes.

4) Preliminary Site Map



5) Alignment with Vision Elements

Spokane proposes a transportation innovation proving ground where, in different measures, all twelve of the US Department of Transportation’s Beyond Traffic vision elements will be addressed in a unique environment for mobilizing new concepts by researching and analyzing integrated models, testing and refining outcomes and producing prototypes for scaling to larger, more complex urban environments.

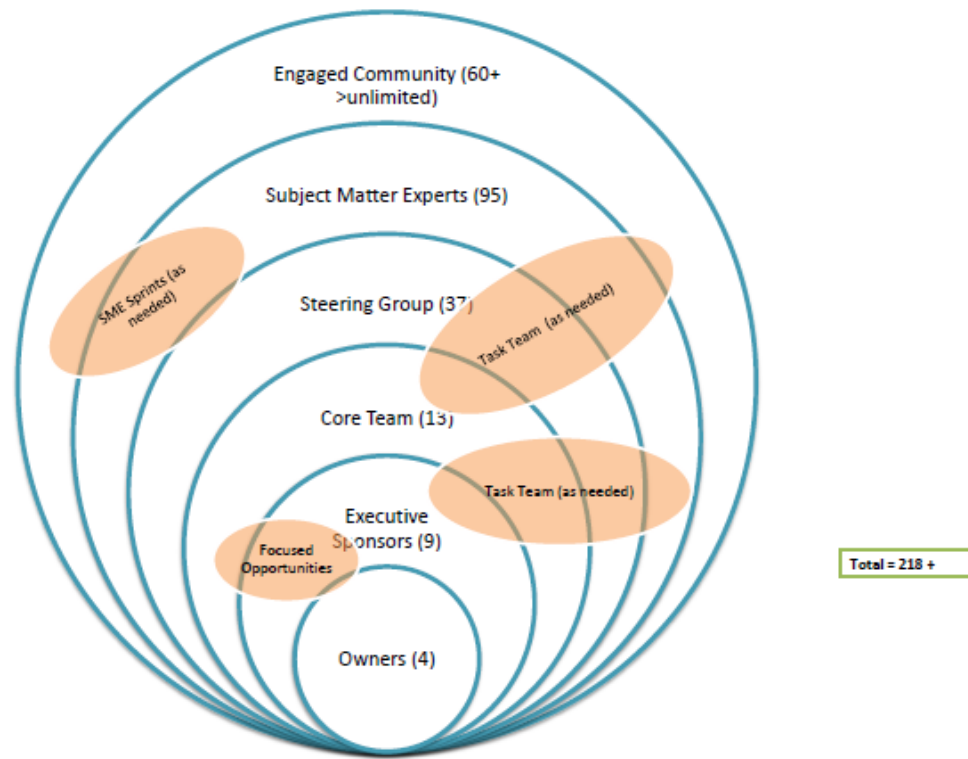
6) Technical, Policy and Institutional Risks

Spokane has been discussing the technical, policy and institutional risks this initiative for nearly two years. The graphic below depicts our current evaluation of strengths, weaknesses, opportunities and threats.



7) Partners, Stakeholders and Governance

The graphic below illustrates Spokane's program management model.



Definitions:

- Owner: The ultimate decision makers and customer/client for the work by the Core Team
- Executive Sponsor: Vision and work direction to the Core Team
- Core Team (May, 2015 on): Hands-on participation - weekly to daily engagement
- Steering Group: Sounding Board - direct, active stakeholder
- Subject Matter Expert (SME): Contributes unique perspective and/or advice relative to critical success factors
- Engaged Community: Actively interested; connectors and collaborators

8) Existing Transportation Infrastructure

Arterial miles

Spokane has 1460 lane miles of residential streets and 760 lane miles of arterial streets.

Freeway and Highway miles within the Spokane City Limits

Route ID	Centerline Miles	Lane Miles
I 90	6.1	36.9
US 2	12.3	56.7
US 195	4.8	18.8
SR 290	4.1	16.1
SR 291	4.7	18.7
US 395	0.4	1.7
SR Total	26.4	112.0

TOTAL	32.5	148.9

Transit services

Spokane Transit Authority provides over 11 million annual passenger trips and travels over 6 million miles within its Public Transportation Benefit Area (PTBA) annually, serving the cities of Airway Heights, Cheney, Liberty Lake, Medical Lake, Millwood, Spokane, and Spokane Valley as well as parts of unincorporated Spokane County. The system includes 34, fixed routes, complementary Paratransit services and a robust vanpool program. There are over 1600 designated stops around the region.

Information and communication technology (ICT)

Spokane is a critically important regional telecommunications hub and home to a multitude of major Tier 1 providers as well as regional Tier 2, Tier 3 and local service providers. Spokane provides redundancy and diversity to numerous carriers and their networks in locations like Seattle, Denver, Portland, and Salt Lake City, as well as the Midwest.

Spokane County is a fiber and telecommunication rich community. Early adaption and private and public investment into digital infrastructure resulted in kudos from publications such as Time Magazine. Spokane has garnered awards from the Intelligent Community Forum and the National League of Cities for technology innovation. The Spokane region was ranked in Sperling's Best Places #12 Best Cities for Teleworking. Spokane is also consistently ranked as one of the safest cities from natural disaster.

The aggressive network build-out of multiple telecommunications companies has left the region's new, commercial, industrial and many beautiful and historically significant buildings wired. Redundancy and diversity in local and regional telecommunications, data networks, energy and power sources is both common, affordable and reliable.

Intelligent Transportation Systems (ITS) including transportation management centers and field equipment

The Spokane Regional Transportation Management Center (SRTMC) was created as a multi-jurisdictional control facility to enhance and support advanced transportation management capabilities. The SRTMC is controlled and funded by the Cities of Spokane and Spokane Valley, Spokane Transit Authority, Spokane County, Washington State Department of Transportation, and the Spokane Regional Transportation Council.

Located in the heart of Spokane at the Intermodal Center (Amtrak rail and Greyhound bus station), the SRTMC is a 900 square-foot facility providing three full workstations for operators, two 84-inch rear projection LCD displays, and nine analog video monitors.

The SRTMC has been a 24/7 operation since November 2003. The center operators coordinate closely with local first response agencies, the regional 911 center, and the state police from Washington and Idaho. From the center, the operators have access and control to most of the region's devices used to monitor and control traffic, which include nearly three dozen closed-circuit TV cameras, six dynamic message signs, twenty traffic measurement stations, and three highway advisory radio stations.

There are currently two Advanced Traffic Management Systems [ATMSs] deployed in the Spokane Region. The ACTRA system was deployed approximately seven years ago for the control of ~220 traffic signals owned and controlled by the City of Spokane. The i2TMS system was deployed in 2001 for the control of closed-circuit cameras [CCTV], dynamic message signs [DMS], and traffic signal control devices owned and controlled by Spokane County, the City of Spokane Valley, and the Washington State Department of Transportation [WSDOT].

The SRTMC includes a center-to-center [C2C] communications link between the ACTRA and i2 systems for sharing traffic data in near real-time. The C2C link passes signal status and traffic volume data from the ACTRA system to the i2 system so that the TMC operators can monitor field operations of the signals. The C2C link was developed in accordance with National Transportation Communications for Intelligent Transportation System Protocol [NTCIP] standards.

The Spokane region has deployed a network of fiber optic communication links along key regional arterials with full build out providing redundant rings. Currently, there is fiber optic cable running along I-90 and along Division (major north-south roadway). Many ITS devices are connected to the fiber optic communication system, such as DMSs, CCTVs, and traffic signals.

The region has also successfully deployed a wireless communication system. Presently, there are six CCTV cameras bringing near real-time video images back to the TMC. There are a few traffic signals that are communicating via wireless communication.

From the SRTMC, the operators have current status information of ITS devices throughout the region, even though there are different operating systems controlling those devices. The regional system collects information about ITS devices and displays that information on a single view. No special software is needed to view the regional system it is a web-services based application, and the user only needs a standard web browser. From a single application, the operator can visually assess freeway flow conditions, view and control CCTV cameras, place messages on DMSs, implement response plans, check the status of traffic signals, and analyze historical traffic performance.

The Spokane system measures traffic volume and speed using roadway sensors (data collection stations). The roadway sensors are remote microwave sensors by EIS. There are a number of data collection stations currently deployed along Interstate 90, with plans for future expansion. These data are collected on 30-second polling periods and stored in a relational database for near real-time and historical analysis. The Spokane system uses the Performance Measurement System [PeMS], which is integrated with the regional system described above. Using the PeMS application, the system users can view roadway performance over a historical time period and view the results in a wide variety of formats. The PeMS system provides users the ability to monitor detector performance, health, and perform troubleshooting, if needed.

Equipment

Traffic signals (approximately 400)

Traffic Signal Controllers

- EAGLE EPAC NEMA controller using ECOM protocol
- EAGLE 2070 ATC using NextPhase over Ethernet (IP communication)
- PEEK 3000 over serial

Vehicle detectors (inductive loops, remote traffic microwave sensors or RTMSs)

Dynamic message signs (DMSs)

Highway advisory radio (HAR)

Video cameras (surveillance, video detection, and traveler information)

CCTV

- Cohu

- Pelco

Weather stations (also called environmental sensing stations or ESSs)

Data Collection Stations

- EIS remote traffic microwave system

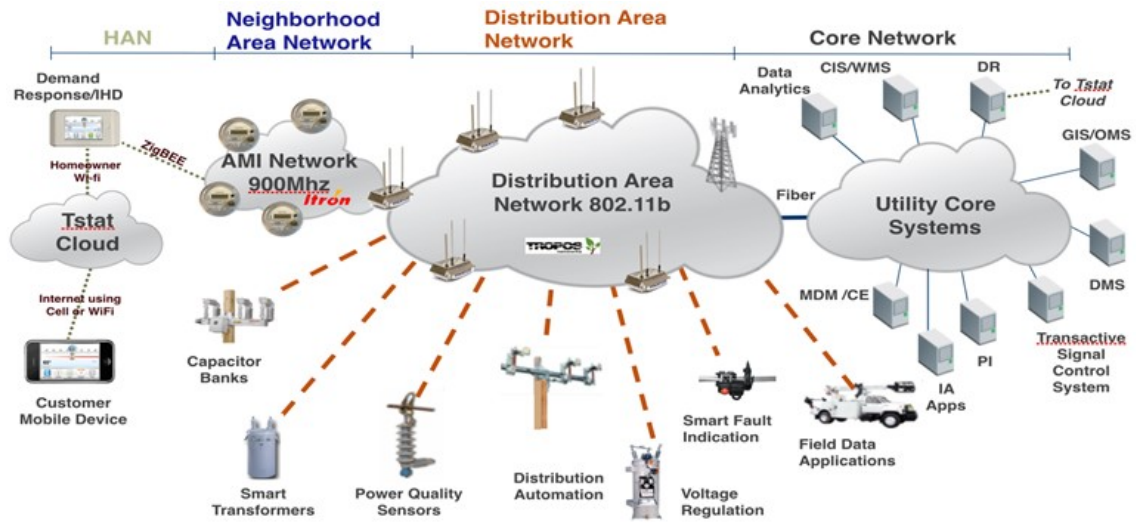
Spokane Transit Authority is currently deploying an expanded suite of Smart Bus technologies built around a new computer-aided dispatch/automatic vehicle location system for the agency's fixed-route fleet. This deployment will also include real-time customer information systems, automated passenger counters, stop announcement, and support for future transit signal priority.

The Spokane Region ITS Plan is available here: http://www.srtc.org/Documents/Documents-Maps/Other_documents/Spokane_Region_ITS_Systems_Plan_2013.pdf

Smart Grid Infrastructure including electric vehicle charging infrastructure

Avista Utilities' Smart Grid Infrastructure is an extremely capable, reliable, automated, and extensible system – providing a solid foundation for additional integration of transportation solutions. It includes fully automated 24x7 distribution grid monitoring and control of field assets and customer meters to improve reliability, capture energy efficiency, and facilitate customer participation. The smart grid components consist of the following; distribution management system (DMS), municipal 802.11 wi-fi network, long range low bandwidth radio network, fiber network backhaul, automated meter infrastructure (AMI), transactive signal control system, smart switches for sectionalizing, smart voltage regulators for voltage management, smart faulted circuit indicators, and smart capacitor banks for power factor correction. The diagram below provides the architectural view of the components. Note: some components are not yet available in the target location in Spokane's University District such as smart transformers and smart thermostats.

The Avista smart grid infrastructure network features are depicted in the following diagram:



Installed components are summarized in the following table:

	Function	QTY	Go Live	Increase Energy Delivery Information	Reduce Energy Losses	Increase Reliability	Improved Energy Information	Voltage Optimization	Integrating Distributed	Extend Life of Existing Infrastructure	Operations Efficiency
Smart Grid Investment Grant Components											
Distribution Management System (DMS)	Hard/Software	1	2013	✓	✓	✓	✓	✓	✓	✓	
Scada Mate Smart Switches and Viper Reclosers	IVVC/FDIR	263	2013	✓		✓	✓	✓	✓	✓	
Capacitors	IVVC	123	2013		✓						
Voltage Regulators	IVVC	174	2013		✓		✓		✓		
Fault Detection, Isolation & Restoration	FDIR	72	2013			✓					✓
Fault Circuit Indicators	FCI	3	2013			✓					✓
Smart Grid Demonstration Project Components											
Distribution Management System (DMS)	Noted Above										
Viper Reclosers	IVVC/FDIR	34	2013	✓		✓	✓	✓	✓	✓	
Capacitors	IVVC	30	2013		✓						
Voltage Regulators	IVVC	39	2013		✓		✓		✓		
Fault Circuit Indicators	FCI	130	2013			✓					✓
Smart Transformers	Load Reporting	360	2012	✓	✓	✓	✓	✓	✓	✓	
Advanced Meter Infrastructure (AMI)											
Open Way AMI Meter Reading System	Hard/Software	1	2011	✓			✓	✓			✓
AMI Smart Meters	Smart Meters	13,000	2011	✓			✓	✓			✓
Gas ERTS	w/900mh Radio	5,000	2011	✓			✓	✓			✓
Customer Experience											
AMI Web Portal	AMI Data Access	13,000	2012	✓			✓				✓
Demand Response - Residential	Thermostats	75	2012								✓
Demand Response - Commercial WSU Partner	Signal	0	2012								✓
Communication Network											
Spokane 802.11 Mesh Radios	Data Collection	485	2012	✓		✓	✓				
Pullman Mesh Radios	Data Collection	90	2010	✓		✓	✓				
Pullman Gateway Radios	Data Collection	20	2010	✓		✓	✓				
Fiber Optic Network	Data Transport	1	2013	✓		✓	✓				

DMS (Distribution Management System)

The DMS system controls all smart field devices remotely and performs automated restoration, conservation voltage reduction (CVR), and power factor correction. The system is a distribution SCADA system with add-on predictive applications to perform Fault Detection, Isolation and Restoration (FDIR) as well as Integrated Volt VAR Control (IVVC). The system leverages a distribution model from Avista's geographical information system (GIS) that provides a connected graphical representation of the feeders

and all its components in the DMS. Given that the predictive applications are model based, the DMS model needed to clearly represent all electrical components, smart and non-smart. An important operational aspect is the real time device status syncing of all devices (smart and non-smart) between the DMS and the GIS based Outage Management System (OMS).

Faulted Circuit Indicators (FCI)

Avista has deployed smart Fault Circuit Indicators (FCI) to further enhance the capabilities of the DMS and the Outage management System (OMS). The FCIs are located at key junction points to detect fault current and help identify the actual location of a fault. The information gathered from the Fault Circuit Indicators is transmitted using On-Ramp wireless communication technology. The On-Ramp technology has a much greater range than 802.11 technology but less data bandwidth.

Fault Detection Isolation and Restoration

One of the predictive applications of the DMS system is Fault Detection Isolation and Restoration (FDIR). FDIR allows for increased reliability for customers with rapid restoration (under 3 minutes) when a feeder breaker has opened due to a fault on the feeder. FDIR analyzes all the fault targets it receives from the switches and breakers along that feeder to determine which section the fault is located in. Once the application determines the fault location, FDIR send commands to the switches or breakers both upstream and downstream of the fault for isolation followed by restoration from available sources.

Integrated Volt/Var Control (IVVC)

IVVC is one of the predictive applications supported by the DMS. IVVC has two main components: Capacitor Bank Control (CBC) and Voltage Control (VC). Capacitor Bank Control (CBC) is the application for power factor correction. CBC allows remotely controllable capacitor banks to be operated based on predetermined and defined KVAR parameters. Every 30 seconds, CBC determines the need for KVAR and controls capacitor banks as appropriate. Voltage Control (VC) remotely controls voltage regulators based on results of a power flow calculation done every 30 seconds which reveals the high and low voltage values on the feeder. These high/low values determine the voltage set point to maximize savings by lowering voltage.

Transactive Signal Control System

The transactive signal control system uses a predictive time series based value signal to inform distributed energy resources, such as electric vehicles, when to complete energy transactions for optimal benefit (both customer and utility). The transactive signal control system has been used for smart thermostats, chillers, air handlers, and generators. The system is easily extended for the application of EV chargers.

Communications

Avista's smart grid data and communications backhaul is supported by a private high speed and high bandwidth fiber infrastructure MPLS backbone that also supports substation integration and corporate network data and voice communications to Avista offices and generation facilities. An 802.11 wireless mesh network blankets the Avista smart devices. An additional low bandwidth, long range network, provided by On-Ramp provides event data from selected field components.

Security

Avista maintains a Cyber Security Plan that is deliberate and strategic with focus on risk assessment, selection of controls, implementation of controls, assessment of controls, authorization for the system of controls, and monitoring the controls. This strategy has been dubbed the "Security Life Cycle Approach"

and is intended to be repeated over time as technologies and their respective risk profiles change and evolve.

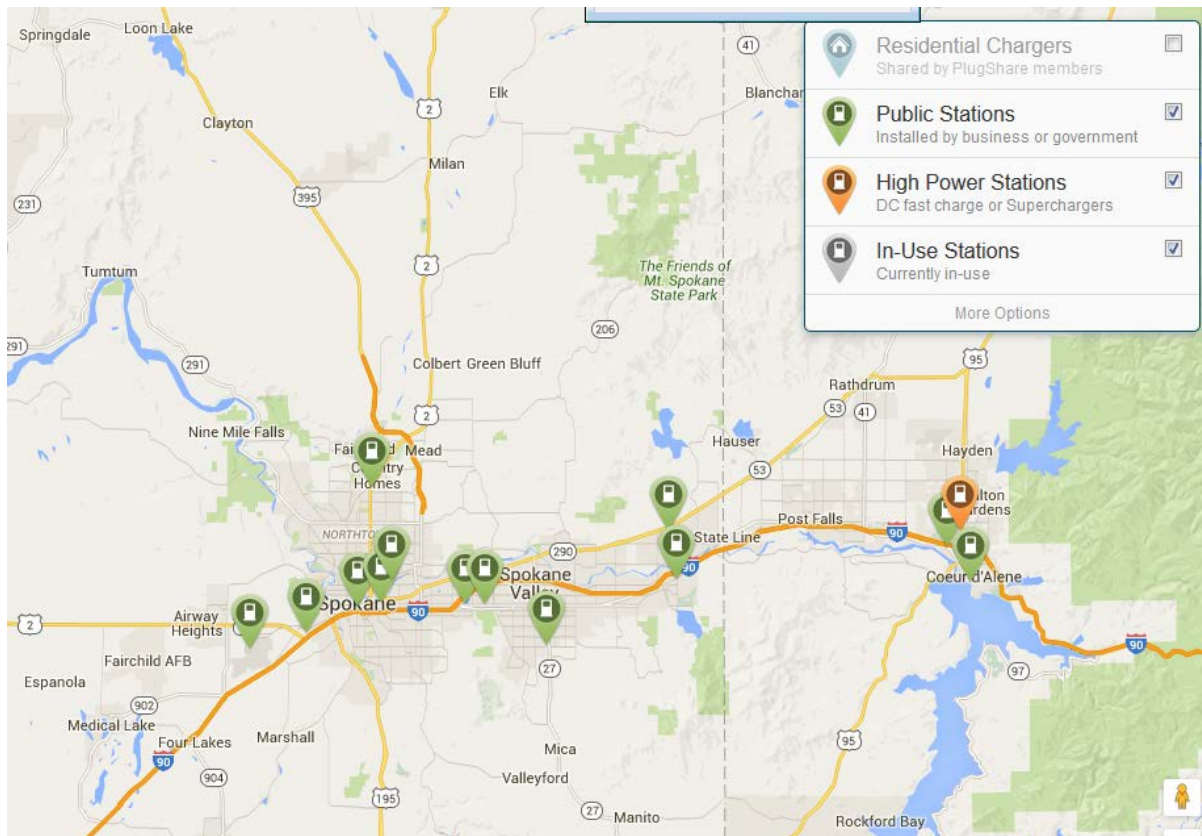
Advanced Metering Infrastructure (AMI)

The advanced meter infrastructure supplied by Itron provides nearly unlimited opportunity at the edge of the grid (customer). The technology provides 1 second measures that can predict many grid anomalies and also facilitate peer to peer transactions with other smart devices leaving unforeseeable opportunities to realize benefits via integration with EV chargers and electric vehicles.

Electric Vehicle Supply Equipment (EVSE) Infrastructure

Current EVSE infrastructure is very limited and is not integrated with the smart grid. The level of current infrastructure will be dramatically increased and carefully located to maximize support for higher EV adoption rates.

EVSE Type	Current Number of EVSE port connections
Residential AC Level 2	unknown
Workplace AC Level 2	unknown
Public AC Level 2	17
Public DC Fast Charger	1



9) Data Integration

Spokane Regional Transportation Management Center

The Spokane Regional Transportation Management Center sustains regional transportation data integration as follows:

- Center-to-center communication using national standards (XML)
- Type of data shared: traffic signal status, phase status, volume and speed data
- Regional Response Plan System: command traffic patterns across two traffic control systems.

The City of Spokane

The City of Spokane is committed to providing information that promotes government transparency and accountability. Citizens are provided with information that encourages and invites public participation and feedback. New datasets will be added periodically, and the City welcomes suggestions.

<https://my.spokanecity.org/opendata/>

City of Spokane Privacy Statement: "All datasets accessed through [the above website] are confined to public information and must not contain personal or privileged information as defined by law, or other information that is protected by statute, practice or legal precedent."

Connected Transportation Innovation Platform

Spokane is building a coordinated network for sensing and communication to support its smart city accelerator and this Smart City Challenge proposal. Coordinated network refers to the fact that partners will design and operate infrastructure that promotes coordination for the purpose of gaining efficiencies. The value proposition centers on shared network backhaul for a variety of digital endpoints. Endpoint owners will take advantage of a coordinated network to transport their data into owner data centers for business operations.

Satisfying the core business operations, the data owners might extend their use of the coordinated network for transportation of shared data elements to a common cloud service platform. The common platform will create opportunity to "mash up" multi-owner shared endpoint data with "Internet of Things" public data. The availability of an analytics engine for "big data" will enable a variety of application development opportunities using a data integration and application as a platform service technology stack (xPaaS).

Use of the coordinated network will facilitate access to a cloud service "platform for innovation".

While there may be several partners/owners of a coordinated network and other infrastructure, there will eventually need to be mutual understanding of the administration, operations and maintenance. A governance team for performance and security management will be formed as an initial step. The coordinated network principles and design parameters illustrated in the following exhibit will guide. Adherence to the evolving principles and parameters will yield a stable operating model. Additionally, operating principles between additional member entities will be developed.

Overarching principles and design parameters:

- **Versatile** infrastructure that can flex with each use case.
- **Common** foundation for **Secure** delivery of data to 'data owner'.
- An architecture that accommodates a **Diverse** and transit endpoint population.

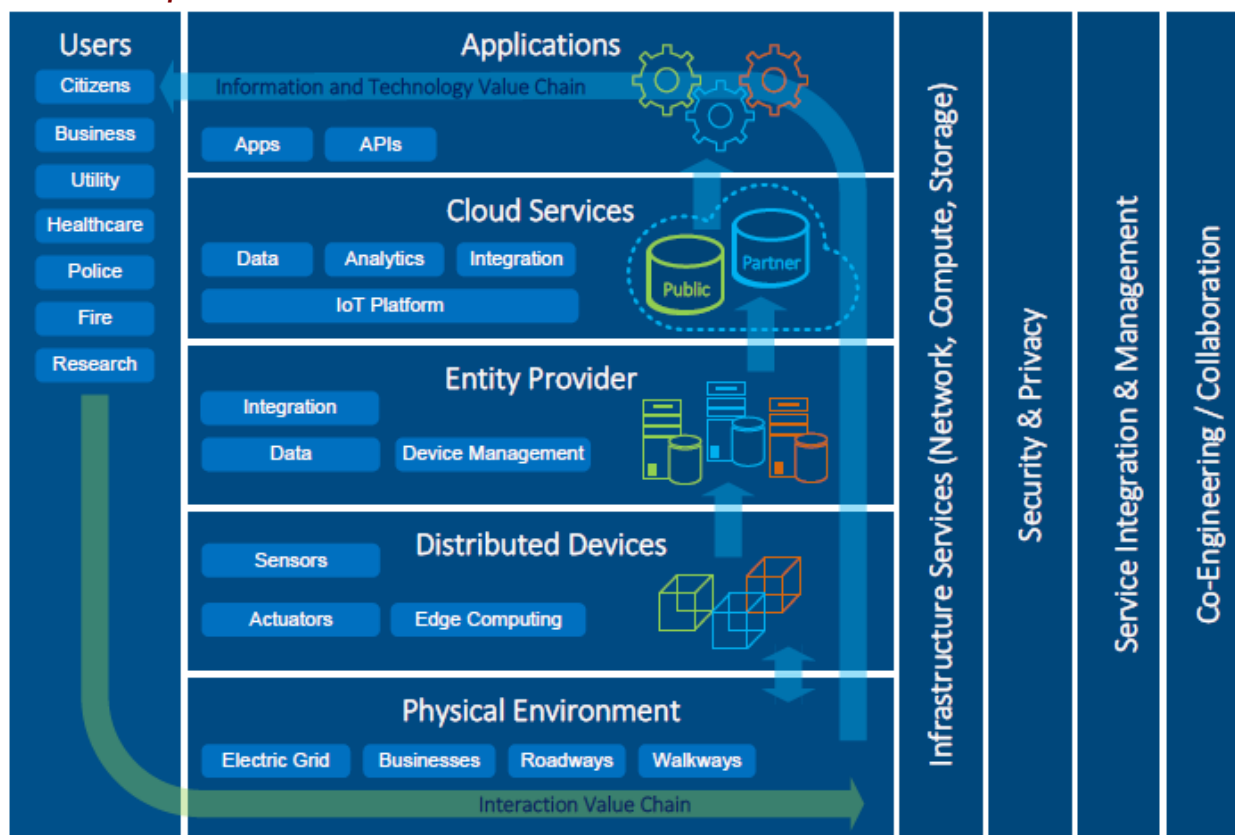
DRAFT Utility and 3rd party - principles/design parameters:

- Endpoint population limited to U-District boundary.
- Endpoint adoption process will include a cross functional governance team.
- Endpoint inventory will be centrally maintained.
- Network design to encompass endpoint and data owner service agreement.
- Network design will align with member data privacy and liability agreement.
- Network design should accommodate endpoint location, environmental conditions (weather, water, landscape, etc.), access control, data volume, application latency requirements.
- Security assessment will precede endpoint provisioning.
- Security Information and Event Management (SEIM) system will be implemented.
- Security event and incident information will be shared with member companies under NDA. Data breach emergency operating procedures will be established.
- 'Big Data' repository and analytics engine will be a cloud service.

DRAFT Operating principles for how City and Avista will approach combined any Services with AMI:

- Endpoint provisioning process team should be defined (RACI)
- Network operate and maintain team should be defined (RACI)
- Service level metrics and problem management operating agreement.
- Change management operating agreement.
- Data privacy and liability agreement.
- Investment or operating cost agreement.
- NDA and public information sharing agreement.

Draft Conceptual Reference Architecture:



The above depiction is a conceptual draft only and has not yet been adopted by the partners. It is provided here as evidence of the thought that has already been invested in the issues of interoperable data sets as well as the security, privacy and sharing thereof.

10) Existing Standards, Architectures and Certification Processes

As shown in Section – Data Integration, all of Spokane’s innovation platform design principles are aimed at complying with and incorporating all existing standards, architectures and certification processes.

11) Measurable Goals and Objectives

Goals and objectives are set for all of the initiatives and projects described in this proposal. The measurable goals and objectives upon award will be accelerated because of the award to achieve desired results in most cases two years sooner than now published.

1. Accelerate the Electric Vehicle Supply Equipment in the Urban Core

With additional funding from the USDOT Smart City Challenge, Avista will quadruple the number of AC Level 2 installed in workplace, fleet, and multiple-unit dwelling (MUD) locations, and double the number of public AC Level 2 and DC fast charging installations.

2. Significantly Accelerate Electrification of Transit System

Present plans for migrating the Spokane Transit Authority fixed-route bus fleet to electric following normal capital equipment replacement schedules have full conversion system-wide by 2031. Under this proposal, it is planned that the Central City Line high performance transit route and other major fixed routes serving the University District will be converted during the performance period.

3. Augment the Transit System Serving the University District

We will expand the availability of the existing Universal Transit Access Pass (UTAP) program and integrate with MOD services and infrastructure. This will require advances in fare technology, distribution channels and a more open data architecture to allow for integration with other mobility providers, including public and private entities. Enhance and improve passenger waiting areas to incorporate additional traveler information that supports this advanced integration of mobility.

4. Accelerate the Full Extent of the ICT/Data Functionality of the University District Smart City Technology Accelerator

The goals described in the Data Integration section will lead the tasks in the resulting funded project.

5. University District Integrated Parking Strategy

The project concentrates on an integrated parking strategy while incorporating broader transit, pedestrian and mobility interests. The goal is to optimize the role played by parking in both economic development and the mobility chain in The University District. The full launch and implementation of this initiative will be accelerated by at least two years with funding from the Smart City Challenge.

6. Generate and Test Complementary Connected Transportation Applications

The resulting platform is designed as a platform for research, development and deployment of all forms. Research proposals are already in the review pipeline for implementation in Spokane's University District.

12) Leverage

The City of Spokane and Spokane Transit Authority have the opportunity to leverage Federal Highway Administration and Federal Transit Administration funding. SRTC is responsible for selecting projects for the federal Surface Transportation Program (STP), Transportation Alternatives Program (TAP), and Congestion Mitigation and Air Quality (CMAQ) program funds. These funds are not eligible for matching other federal funds. However, projects selected under these funding programs could demonstrate partnering (e.g. ITS projects) among regional entities.

City of Spokane University District Transportation Projects				
<i>Project Name</i>	<i>Type</i>	<i>Cost</i>	<i>Primary Funding</i>	<i>Description</i>

USDOT Smart City Challenge - Spokane

1st Avenue	Capital Improvements	\$ 759,390	Local	Residential grind and overlay, ADA improvements, sewer line replacement
3rd Avenue ITS	Capital Improvements	\$ 2,087,161	Federal	Install fiber optic communication and ITS devices
Arthur Street	Street Bond Projects	\$ 250,000	Local	Full depth roadway rebuild with ADA curb ramps and sidewalk installation
Ben Burr Trail Connection	Pedestrian and Bikeways	\$ 1,712,500	Federal	Pave existing Ben Burr Trail and extend to Centennial Trail on Riverpoint Campus
Browne/Division Couplet	Safety	\$ 410,000	Federal	Install countdown timers and ADA improvements
Connect to Transit Hardscape Improvements	Pedestrian and Bikeways	\$ 315,000	Federal	Complete a sidewalk gap and improve curb ramps and bus landings
Division Street DMS	Capital Improvements	\$ 1,676,900	Federal	Install digital message signs
Division Street	Pedestrian and Bikeways	\$ 3,853,686	Federal	ADA improvements, traffic signal adjustments, on-street parking improvements, lane reconfiguration lighting, streetscape and sidewalk
Division Street ITS	Capital Improvements	\$ 1,227,165	Federal	Install fiber optic communication and ITS devices
Erie Street	Capital Improvements	\$ 410,000	Local	Paving and ADA improvements to tie into Riverside project
Hamilton Street Corridor Enhancement	Impact Fee Projects	\$ 3,074,000	Local	Construct traffic signal modifications to accommodate for protected/permitted left turns and improve traffic flow
I-90 Division Street Gateway Enhancement	Capital Improvements	\$ 1,638,000	Local	Construct aesthetic and functional streetscape improvements at interchange ramps with I-90
Riverside Drive Phase 2 & 3	Capital Improvements	\$ 10,617,800	Federal	Extend Riverside (MLK Way) to Trent with bike lanes and sidewalks
Sharp Avenue Pervious Pavement Pilot Project	Capital Improvements	\$ 1,335,000	Local (integrated)	Install pervious asphalt in travel lanes, curb extensions, and restripe to different alignment

Sprague Avenue Rebuild	Capital Improvements	\$ 11,350,000	Local	Fulfill elements of corridor investment strategy by implementing 3-lane section, streetscape and traffic signal improvements, landscaping and integrated storm water
U-District Pedestrian and Bicycle Bridge	Pedestrian and Bikeways	\$ 16,599,100	State and Local	Construct ped/bike bridge to connect Riverpoint Campus with the South U-District, across MLK Way and BNSF tracks
	Total Project Costs	\$ 57,315,702		

Conclusion

The Smart City is, fundamentally, no different from great cities: a people place. The Smart City places the needs and aspirations of its people ahead of competing priorities. Technology is the means and not the end of this vision..... The US Department of Transportation and Vulcan Foundation dollars invested in Spokane will go farther toward the goals of Beyond Traffic 2045 than possible in any other mid-sized city.

Part II Application Standard Forms and Organizational Information

Standard Forms

(SF 424; SF424A; SF424B; SFLLL and Organizational Information are provided in pdf format as a separate document)