SMART DALLAS ROADMAP

A Guideline for a Smarter Dallas

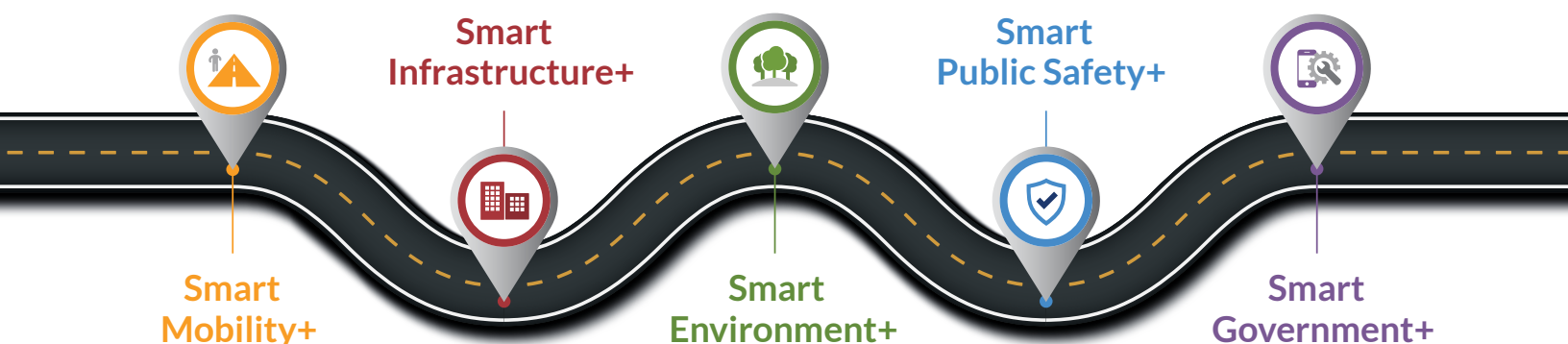**City of Dallas**

EVOLVING DALLAS INTO A SMART CITY

This Roadmap is, first and foremost, about Dallas' approach to being a Smart City, with technology, data and intelligence as enablers.

The challenge for our cities has never been greater: increasing demands on services and infrastructure, reducing budgets, increasing expectations, concerns about the environment and global competition. From all these perspectives, we need our cities to work better—for our residents, businesses and visitors. Advances in technology and data analysis provide us with the tools to better understand the functioning of our cities and to plan and deliver services more effectively. But the challenge is more than just how we improve our services; it is also how to improve with the most efficient and effective approach.

Implementing the Smart Dallas Roadmap as a horizontal objective has played an important role regarding documents and projects in the development of the City so far. This Roadmap is, first and foremost, about Dallas' approach to being a Smart City, with technology, data and intelligence as enablers. The purpose of publishing this Smart Dallas Roadmap is to begin this process of change—a change that puts Dallas at the forefront of public service transformation and true leaders in the business of providing solutions to urban challenges. The word "business" is used advisedly: urban innovation is becoming a massive global market, estimated to be worth over $400 billion by 2020. By taking a leading role, we will not only improve the quality of life in Dallas, but also provide a source of high-value opportunity.

An increasing number of cities are turning to "smarter" approaches in planning their future, in creating modern infrastructures and in delivering services. Dallas has been playing an important role in shaping thinking as to how innovation can be harnessed to improve cities, particularly in the development of national and international standards. The City is committed to adopting such "Smart City" approaches to cope with the many challenges ahead and to create new opportunities for business and local communities. This Roadmap sets out how the City proposes to do that and underpins and complements its overall Strategic Priorities.

Please see the following link for details on Dallas' Strategic Priorities:
http://dallascityhall.com/government/citymanager/Pages/strategicplan.aspx

Smart Mobility+

Smart Infrastructure+

Smart Environment+

Smart Public Safety+

Smart Government+

DALLAS CITYWIDE STRATEGIES

The Smart Dallas Roadmap is the link between the Technology+ Strategic Plan and the Citywide plans—a link that explores how data, insights and technology can be used to realize the vision, goals and actions described in the Citywide plans in a Smart way.

The City of Dallas has adopted a number of Citywide plans that provide guidance on all aspects of City governance and growth—from transportation to the environment and from economics to neighborhood planning. These plans are largely focused on planning and urban design and policy perspectives. Dallas also has published a Technology+ Strategic Plan, which provides the Citywide technology strategy and principles. The Smart Dallas Roadmap is the link between the Technology+ Strategic Plan and the Citywide plans shown below—a link that explores how data, insights and technology can be used to realize the vision, goals and actions described in the Citywide plans in a Smart way.

To view more about Citywide plans, please visit http://dallascityhall.com/departments/pnv/Pages/Citywide-Plans.aspx

Dallas' Technology+ Strategic plan: http://dallascityhall.com/departments/ciservices/DCH%20Documents/City-of-Dallas-Technology+StrategicPlan.pdf
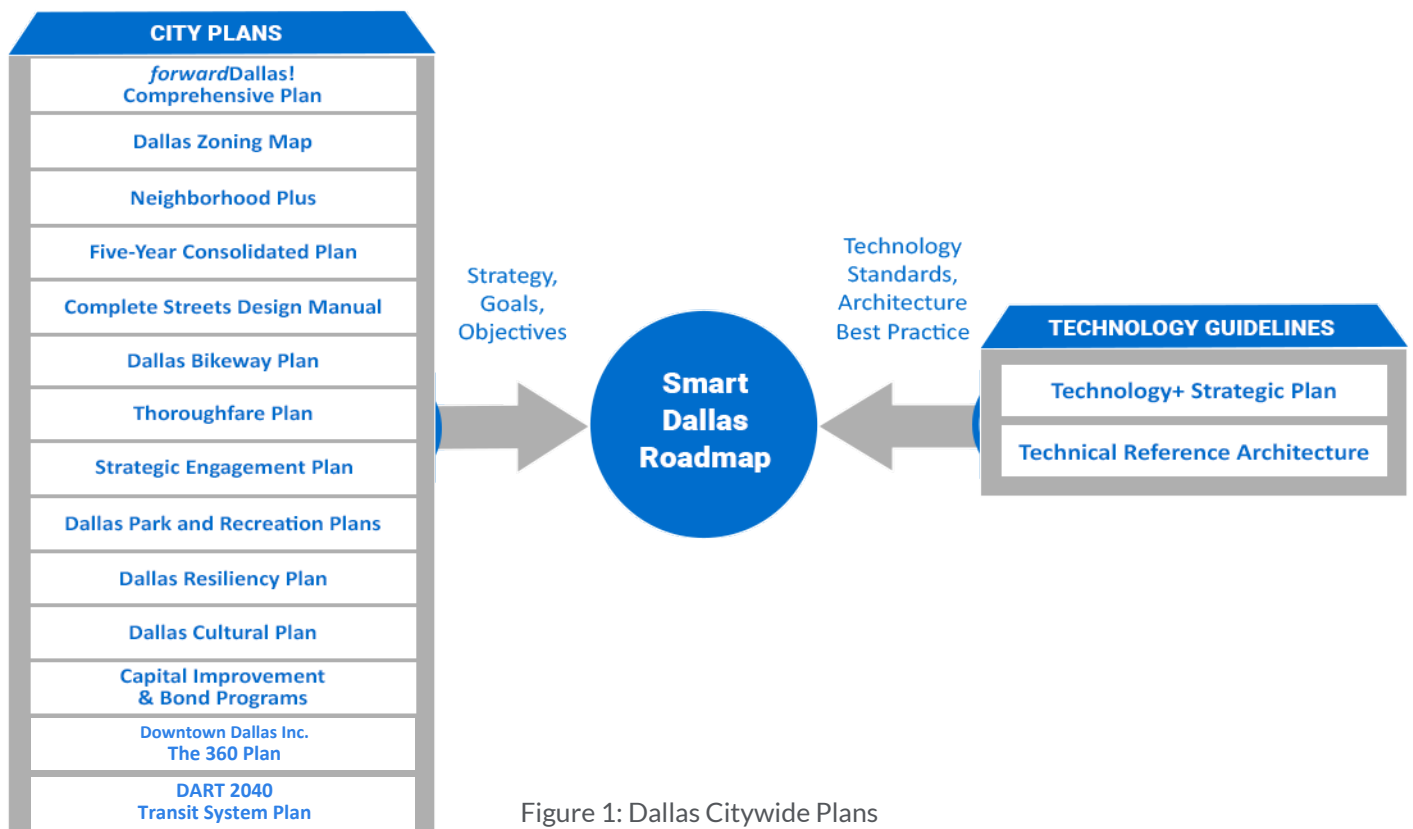
Visit Dallas' Smart City website at DallasSmartCity.com
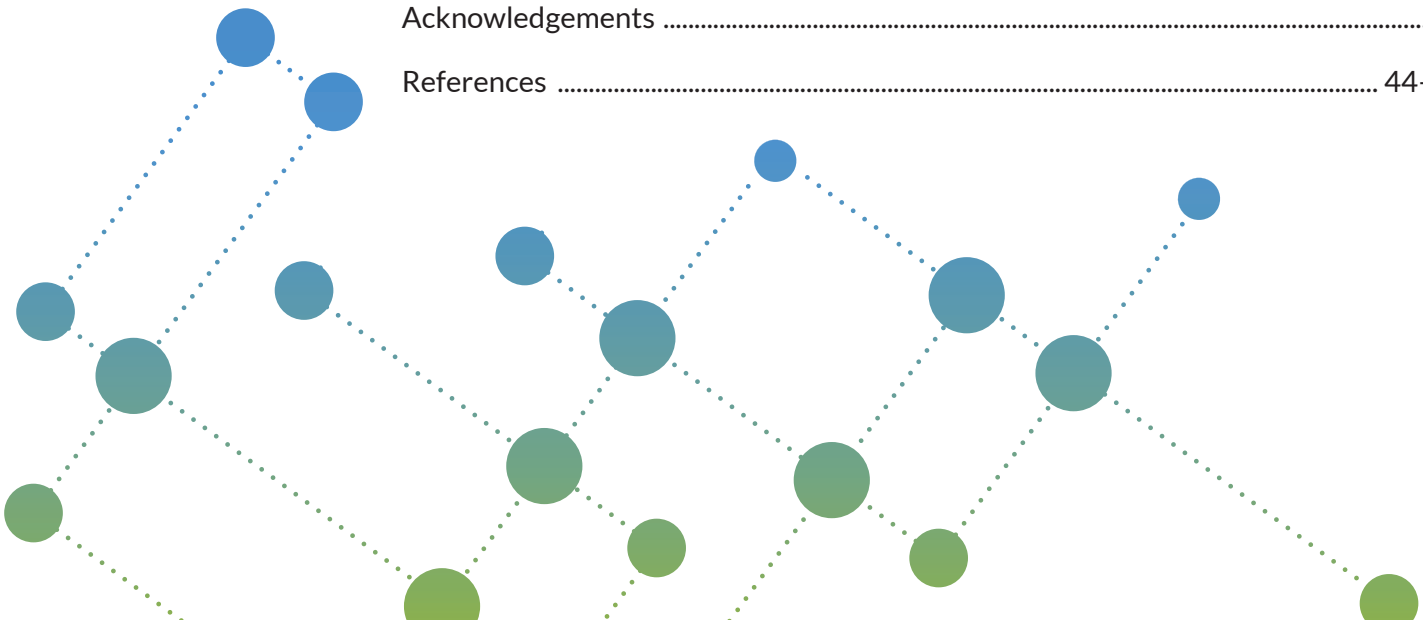
Figure 1: Dallas Citywide Plans

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"Big things happen here. Join us on our journey for creating a better Dallas!"

— T.C. Broadnax, City Manager

WHAT MAKES A CITY SMART?

A Smart City is one that focuses on improving the quality of life of all citizens by adopting new forms of governance, public participation, process improvements, technology adoption, data-driven decision making and providing sustainable services.

WHAT MAKES A CITY SMART?

The complex nature of the urban environment and how it evolves over time in response to technological, economic and social change requires a systemic approach, which draws on the full range of policy instruments.

The term "Smart City" was coined near the end of the 20th century. It was rooted in the implementation of user-friendly information and communication technologies developed for urban spaces. Its meaning has since been expanded to relate to the future of cities and their development. Smart cities are forward looking, progressive and resource efficient providing, at the same time, a high quality of life. They promote social and technological innovations and link existing infrastructures. Their focus is on new forms of governance and public participation, intelligent decisions, incorporating new energy, and traffic and transport concepts that are environmentally friendly. It takes more than individual projects; it takes careful decisions on long-term implementations. Considering cities as entire systems can help them achieve their ultimate goal of becoming smart.

For some, being a Smart City is simply investing in ultra-fast broadband and other digital technologies or installing a management control center and a range of technology solutions to specific challenges. In truth, there is no digital "silver bullet"—the complex nature of the urban environment and how it evolves over time in response to technological, economic and social change requires a systemic approach, which draws on the full range of policy instruments. The Smart City concept is certainly underpinned by the use of technology and the ability to collect, transmit, manage and interpret data, and make it available, to enable both service providers and users to make better decisions. Smarter use of new technology also enables cities to be designed and planned more effectively, to manage demand for services and encourage citizens to use lower- cost modes of delivery, i.e., to promote "channel shift."

SMART DALLAS — GUIDELINE FOR THE FUTURE

Dallas' early Smart City innovations were primarily focused on the value of Citywide enablers when delivering a variety of smart solutions and the impact to citizens and businesses in the community.

Dallas' early Smart City innovations were primarily focused on pilot programs in the Arts District and the West End, with the purpose of evaluating smart technologies. These initiatives focused on the value of Citywide enablers when delivering a variety of smart solutions and the impact to citizens and businesses in the community. Now, the City of Dallas has partnered with City leadership, business partners and nonprofits with the intent to accelerate the Smart Dallas Program and establish a long-term vision for a smarter Dallas. The activity has culminated with the publication of this roadmap, which introduces the Smart Dallas focus areas and framework and lays out a short- and long-term actionable plan. Thus, in our view, a "Smart City" is one that:

- Provides clear leadership and drive while engaging with citizens and businesses in a transparent manner.

- Provides an education and skills infrastructure that offers all citizens the opportunity to participate in the digital economy and to secure well-paid employment, regardless of sector.

- Has the mechanisms, resources and culture in place to support agility and innovation within its own public services, i.e., it is a "learning organization," able to manage risk and develop new approaches in a timely and cost-effective manner, in order to deliver high-quality services that engage with and meet the needs of citizens, rather than to support organizational convenience and traditions.

SMART DALLAS — CURRENT AND FUTURE CHALLENGES

By utilizing the Smart Dallas program to address these challenges, Dallas can continue to grow to be the most attractive city for economic growth, environmental sustainability and citizen inclusion.

As the ninth largest city in the United States, Dallas has an extremely diverse population from different socioeconomic backgrounds and ranging in ethnicities, ages and educational attainments. With a robust job market, affordable cost of living and high quality of life, Dallas is a city that is rapidly growing every year, with the sixth highest 2015–2016 population growth of any city in the United States. The influx of over 100,000 people moving to the Dallas–Fort Worth (DFW) metroplex every year brings many challenges, including a higher strain on existing resources and a larger impact on the environment as well as the need to ensure equitable access to the benefits of this growth.

Dallas needs to optimize City operations and practice data-driven citizen engagement to become more efficient, effective and smart, thereby reducing the burden and ensuring high quality of life for all citizens. By utilizing the Smart Dallas program to address these challenges, Dallas can continue to grow to be the most attractive city for economic growth, environmental sustainability and citizen inclusion.
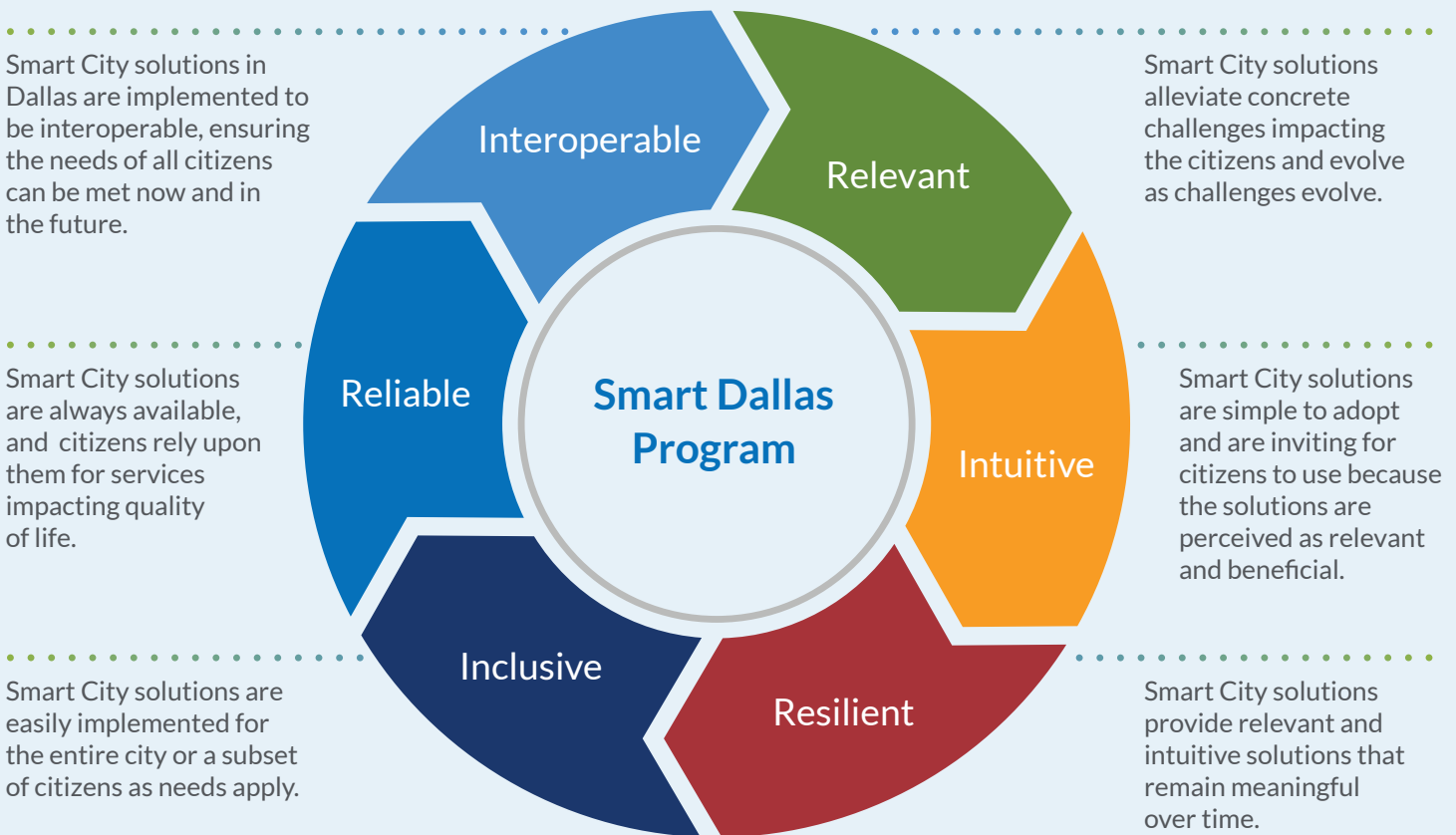
Smart City solutions in Dallas are implemented to be interoperable, ensuring the needs of all citizens can be met now and in the future.

Smart City solutions alleviate concrete challenges impacting the citizens and evolve as challenges evolve.

Smart City solutions are always available, and citizens rely upon them for services impacting quality of life.

Smart City solutions are simple to adopt and are inviting for citizens to use because the solutions are perceived as relevant and beneficial.

Smart City solutions are easily implemented for the entire city or a subset of citizens as needs apply.

Smart City solutions provide relevant and intuitive solutions that remain meaningful over time.

Interoperable · Relevant · Intuitive · Resilient · Inclusive · Reliable · Smart Dallas Program

Figure 2: Smart Dallas Programs

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SMART DALLAS — CURRENT AND FUTURE CHALLENGES

Optimization and Incremental Improvement of City Services

One of the key aspects of enabling high quality of life is ensuring the efficiency of government processes required to interact with and provide citizens services in the community, such as 311 requests and permit requests. Digitalizing historically paper-driven processes to reduce the total time required and provides citizens more visibility throughout the stages of the process is a key challenge in moving toward a more effective Smart Dallas government. In addition to increasing user satisfaction, the digitization of government services can also save money, reducing the cost burden.

Focus on Citizen Safety

Public security is a growing problem for cities worldwide. The world's cities are bursting at the seams, civic resources are under pressure, and crime is harder than ever to police. As it stands, most video surveillance technology is inefficient. Police investigations are often hampered by blind spots in video networks and low-quality imagery.

Mobility Challenge

Mobility and congestion are challenges for every city. The grand vision of vehicles moving freely and efficiently down wide-open highways and city avenues has devolved into mile after mile of traffic congestion and pollution. The latest mass transit and e-mobility technologies blend flawlessly into city infrastructures— from monorail and metro systems running through buildings, at-grade, elevated or underground, to new solutions for electric vehicles. These attractively designed mobility solutions support the urgently needed shift in thinking from traditional transport modes to electric public transport.

Addressing the Growing Digital Divide

Interaction between human and computers has greatly increased as we embark on the 21st century. The ability to access computers and the internet has become increasingly important to completely immerse oneself in the economic, political and social aspects of not just America but the world. However, not everyone has access to this technology. The idea of the "digital divide" refers to the growing gap between the underprivileged members of society, especially the poor, rural, elderly and handicapped portion of the population who do not have access to computers or the internet, and the wealthy, middle-class and young Americans living in urban and suburban areas who have access.

SMART DALLAS — CURRENT AND FUTURE CHALLENGES

Infrastructure Demands

Cities across the United States are coping with aging and failing infrastructure systems. What is less apparent is that cities often face many of the same overwhelming, chronic and costly infrastructure problems. The abundance of digital technology combined with ever more intuitive software has transformed education, finance, health, media and manufacturing. Applying digital technology and thinking to our physical assets too offers the potential to use our assets more intelligently, finding efficiencies and better meeting society's needs.

Structuring Innovative Partnership

Given the fast-evolving technology landscape, Cities need to rapidly adopt new technology to optimize and improve efficiencies. With constrained resources, Cities must look for new Models to meet citizen needs. The Public–Private Partnership (PPPs) is a cooperative institutional arrangement between public- and private-sector actors to speed up these adoptions. More cities are leveraging their regional and global partners to adopt these changes at the pace that can satisfy citizen demand.

Data Transparency and Data-Driven Decisions

A Smart Dallas needs to holistically view and pull insights from data across the City's 40+ departments. This provides value for government officials to make data-driven decisions and for customer support representatives to provide data-driven, data-intelligent support to the citizens. The importance of cross-initiative and cross-department data sharing is essential to optimizing the services provided to the citizens across all Smart City projects or Smart Domains—Smart Mobility+, Smart Infrastructure+, Smart Environment+, Smart Public Safety+ and Smart Government+. In addition to optimizing efficiencies internally, providing key data-driven insights to citizens to increase the levels of transparency is a challenge the City of Dallas is currently making great strides to address.

SMART DALLAS — CURRENT AND FUTURE CHALLENGES

Equitable Access to Economic Growth

Dallas faces disparity in access to economic growth. Currently, 55 percent of citizens living north of the Trinity provide 85 percent of the tax base; in other words, South Dallas contains 54 percent of the City's area (185 square miles) but only provides 15 percent of the tax base.[1] As the Dallas economy grows, one challenge is to enable all citizens to have equitable access to the additional jobs. Ensuring equitable access to the economic growth Dallas is enjoying necessitates the citizens have efficient, safe and affordable access to reliable transportation, ensuring their ability to access employment and education opportunities. In addition to accessing economic growth in other areas of Dallas, a key challenge in addressing the economic disparity is enabling communities to increase their attractiveness and grow local jobs.

Strain on the City's Resource Availability and Environment

Growth impacts environmental resources due to increased generation of pollutants. Poor air quality is a persistent environmental challenge for the entire DFW region, including all of Dallas. It has direct effects on residents. Poor air quality reduces quality of life and exacerbates respiratory issues, especially among children, with minority and low-income communities being disproportionately affected. From a Smart Cities perspective, Dallas has a holistic focus on reducing fuel use, increasing use of renewable energy sources and improving energy efficiency, to reduce the amount of greenhouse gas emissions and offset some impacts of the population increase to the community. As Dallas grows and continues to develop land, an urban heat island effect becomes a growing concern for the quality of life of Dallas citizens. The Dallas 2017 Urban Heat Island Management Study[2] has shown that Dallas experiences a 9 degrees F heat island intensity in the most highly impacted areas.

Budgetary Challenge

Cities and their surrounding suburbs are important economic agents that not only provide services essential to the functioning of regional economies, but also serve as major employers in many metro areas. Operational budgets are created based on requests from competing stakeholders, each justifying their projected expenditures based on their departmental needs rather than the overall goals of the organization. This process by itself leads to the challenges of not focusing on Smart Cities as a program and not budgeting for the long term, and these are common budget challenges with regard to Smart Cities.

[1] Grow South Plan, 10 November 2017. [Online]. Available: http://www.dallasgrowsouth.com/category/growsouthplan/.
[2] T. T. T. Foundation, "Dallas Urban Heat Island Management Study," The Texas Trees Foundation, 2017.

SMART DALLAS — VISION AND PRINCIPLE

Our Smart Dallas vision is to be a vibrant metropolis and one of the United States' most attractive cities by 2030.

Smart Dallas' principle is to provide a unified approach to technology, data and intelligence in delivery of smart solutions.

Our vision for Smart Dallas is to be a vibrant metropolis and one of the United States' most attractive cities by 2030. This position is based on strategically planned, long-term measures of the City, which to date has led to a noticeable improvement in all fields of life: public safety, quality of living, sustainability and prosperity, as well as quality and quantity of educational options and workplaces. Smart Dallas 2030 dynamically adapts to the needs of the citizens and intends to have the highest level of citizen engagement by providing a continuous feedback loop to citizens with insights on how the citizens are impacting their communities and how City infrastructure and services dynamically adapt to citizens' needs.

Smart Dallas 2030 is based on a horizontal approach to technology, data and intelligence in the delivery of smart solutions.
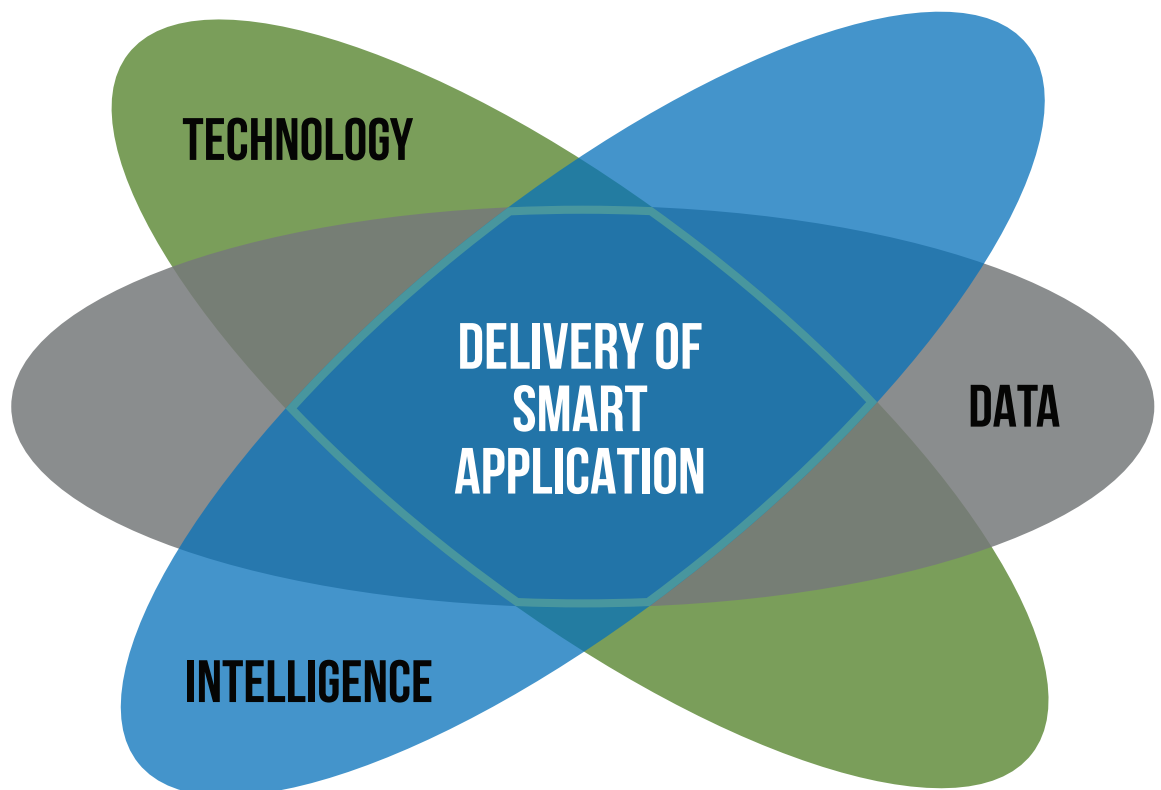

Figure 3 : Smart Dallas Vision and Principle

SMART DALLAS — DOMAINS

The Smart Dallas Domains help address our core strategic priorities and, at the same time, leverage technology, data and intelligence to deploy a scalable, sustainable Smart Dallas appro

The basic requirement of being a Smart City is the stable and consistent operation of the City, providing high-quality, efficient public services equally accessible for all. The increase of service and supply security shall cover all areas of City operation from public utilities to transport services to general information access and coverage. The quality of service shall be unified throughout Dallas regardless of the geographical and social features of the particular area.

The purpose of the Smart Dallas Domains is to enable better planning, managing and governing of City services in a sustainable way to maximize efficiency. Based on the current and future challenges that we face, the Smart Dallas Domains help address our core strategic priorities and, at the same time, leverage technology, data and intelligence to deploy a scalable, sustainable Smart Dallas approach.

Figure 4: Smart Dallas Domains

SMART DALLAS — GOALS

Dallas defines five core functional areas that will not only help lay the foundation but also sustain its Smart City vision.

Many cities all over the world have been starting to develop their own smart strategies, aiming at improving the quality of life of citizens and reducing their environmental footprint. Goals to become a Smart City are of paramount importance for effectively driving the policies in implementing smart initiatives pursuing shared goals. Smart City benefits are often declared but not measured; to better define Smart City performance is indispensable for realizing better outcomes for citizens and other stakeholders. To better focus on Smart Dallas efforts and leveraging technology to enable the required change, Dallas defines five core functional areas (Smart Domains) that will not only help lay the foundation but also sustain its Smart City vision.

Smart Mobility+

Mobility is one of the most difficult topics to face in large metropolitan areas like Dallas. It involves both environmental and economic aspects, and needs both high-tech and sustainable people behaviors. **Smart Mobility+** includes smart solutions to improve, innovate, and visualize reliability, efficiency, and access to public and private transportation and the associated support infrastructure to address the strain population growth places on the transit systems.

Smart Infrastructure+

Smart Infrastructure+ focuses on leveraging solutions to improve utilization, energy and water efficiencies, and heat management and to reduce environmental impact as applicable to current and future infrastructure in Dallas.

Smart Environment+

Smart Environment+ includes smart solutions to ensure a healthy environment and the associated quality of life and health effects for all Dallas citizens.

Smart Public Safety+

Smart Public Safety+ includes smart solutions to improve citizen safety and reduce crime. For Dallas, this is particularly important to support community revitalization efforts in disadvantaged areas experiencing blight and high crime rates.

Smart Government+

Smart Government+ includes inclusive smart solutions to digitize and simplify the processes necessary to provide services to citizens and businesses as well as to provide intelligent insights to citizens regarding their impacts on their community.

SMART MOBILITY+

Smart Mobility+ Goals

+ Increase Capacity of Existing Infrastructure

+ Reduce Congestion and Commute Times

+ Reduce Emissions

+ Provide Equitable Access to Transit

SMART MOBILITY+

Smart Mobility+ enables insights across the entire transit ecosystem.

Smart Mobility+ responds to the transportation needs of the City's people and businesses, addresses climate change, advances social equity and environmental justice, and supports economic and community development. Smart Mobility+ moves people and freight while enhancing Dallas' economic, environmental and human resources by emphasizing:

- Convenient and safe multimodal travel
- Speed suitability
- Accessibility
- Management of the circulation network
- Efficient use of land

Smart Mobility+ specifically addresses correlation of data from multiple sources, e.g., pedestrian, bicycle, mass transit, commercial and traffic camera data, into a holistic view of the Dallas congestion. More importantly, by enabling insights across the entire transit ecosystem, decisions can be made based on models that consider multiple sources of congestion—and multiple possible mitigation solutions.

SMART MOBILITY+

Multimodal Transit

The interactive multimodal transit navigation interface will provide route options that consider both private and public transit modes, such as private vehicles, parking availability, public transit, ride sharing, connected vehicles, bike sharing and walking, and the transfer between different modes.

Intelligent Insights and Congestion Reduction

Metrics on the most common commuter routes, including bicycle and pedestrian, last-mile transit, mass transit, etc., should be measured to enable further optimization of alternative commuters on those routes and track greenhouse gas emission savings.

Dynamic Adaptations
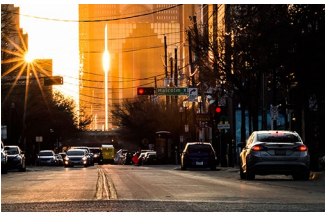
Implement a traffic signal ecosystem that can be adapted to changing situational needs in near real-time to improve efficiency and safety of transport in nonstandard circumstances, e.g., enabling traffic management to dynamically update traffic signal timing during an accident scenario.

Commuter Safety

Use smart technology and data to increase safety for bicycle commuters, reduce the number of cyclist accidents and provide valuable inputs to City planning.

SMART INFRASTRUCTURE+

Smart Infrastructure+ Goals

+ Conserve Water

+ Increase Energy Efficiency

+ Leverage Infrastructure Horizontally

SMART INFRASTRUCTURE+

Our smart system can monitor, measure, analyze, communicate and act based on information captured from sensors.

A smart system uses a feedback loop of data, which provides evidence for informed decision-making. The system can monitor, measure, analyze, communicate and act based on information captured from sensors. Different levels of smart systems exist.

Smart Infrastructure+ responds intelligently to changes in its environment, including user demands and other infrastructure, to achieve improved performance. Smart Infrastructure+ is enabled by:

- Collecting usage and performance data to help future designers to produce the next, more efficient version.
- Collecting data, processing the data and presenting information to help a human operator make decisions (for example, traffic systems that detect congestion and inform drivers).
- Using collected data to take action without human intervention.

Resource Conservation

Implement solutions to enable conservation of natural resources, such as water and energy, or to reduce waste generation.

Energy Efficiency

Implement building efficiency solutions to conserve energy, such as optimized lighting and HVAC, based on facility usage.

Improved Infrastructure

Update infrastructure with intelligent sensor networks for real-time insight generation and optimization of service delivery.

Implement infrastructure in such a way that it can be leveraged horizontally across numerous domains.

Improve infrastructure to provide necessary data for predictive analytics of maintenance needs.

SMART ENVIRONMENT+

Smart Environment+ Goals

+ Improve Air Quality Monitoring

+ Enable Smart Water Management

+ Reduce Waste

SMART ENVIRONMENT+

Smart Environment+ enables the public to be informed regarding the environmental quality in their neighborhoods.

Smart Environment+ enables the public to be informed regarding the environmental quality in their neighborhoods and utilize this feedback loop to take actions that improve the environmental quality in our local ecosystems. As the accuracy and resiliency of low-cost environmental monitoring technology improves, use of smart environment technology to address the challenges facing citizens becomes more feasible. Dallas' approach to Smart Environment+ is focused on:

- Use of low-cost, accurate and resilient smart environment technology to provide real-time, localized information on environmental quality and related processes.

- Transparency for the public to near real-time data and insights coming from the smart environment technology.

- Commitment to promoting data interoperability in the Smart Environment+ space. Private and nonprofit, environmentally focused organizations are also looking at various aspects of environmental quality in Dallas, and the ability to leverage data across organizations, if desired, is the purpose of this commitment.

- Clarity for citizens' regarding how their actions are impacting the environment.

SMART ENVIRONMENT+

Improve Air Quality Monitoring

With chronic poor air quality in Dallas, providing visibility into local air quality variations is desired but challenged with the current footprint of air quality monitors in Dallas. From a Smart Cities perspective, low-cost, nonregulatory air monitors have significant potential to provide valuable data that could enhance public health, traffic flow, urban planning, zoning and nuisance abatement.

Smart Water Management

The aging wastewater management infrastructure in Dallas requires many updates and provides a large scope of work for maintenance every year. Implementing smart water management sensors and monitoring equipment to provide data for analysis of the locations most in need of maintenance or updates would provide an enhanced view for City planning.

Waste Reduction

Dallas has waste reduction targets and has recently won awards for a new state-of-the-art recycling plant. Providing additional visibility into the results of the waste reduction and recycling efforts in Dallas is a desirable data transparency metric.

SMART PUBLIC SAFETY+

Smart Public Safety+ Goals

+ Improve Public Safety

+ Increase Attractiveness for Local Economic Growth

+ Provide Community Engagement and Transparency

SMART PUBLIC SAFETY+

The approach for Smart Public Safety+ in Dallas is to use data and technology to help ensure a high quality of life for all Dallas residents and visitors.

The public safety departments can utilize Smart Public Safety+ technology to improve response times and reduce crime rates. In a Smart Dallas, citizens should have access to current, holistic views of public safety insights and metrics for their neighborhoods. The approach for Smart Public Safety+ in Dallas is to use data and technology to help ensure a high quality of life for all Dallas residents and visitors by emphasizing solutions that:

- Leverage big data and predictive analytics to prioritize crime prevention activities appropriate to the variety of public safety needs across the Dallas landscape.
- Promote community engagement and transparency.
- Improve inter- and intra-agency collaboration.

Data-Driven Policing

Implement smart and predictive analytics use cases to help Dallas police prevent and detect crime.

Intelligent Emergency Response

Implement a 911 system with the highest resiliency level and support for the latest industry technology and features.

Utilize smart street lighting for adaptive response to public safety incidents.

Community Engagement

Provide visibility to the community of the impact of the smart public safety solutions and their local public safety metrics.

SMART GOVERNMENT+

Smart Government+ Goals

+ Provide Citizens On-Demand Access to City Services

+ Reduce Government Costs and Improve Efficiencies

+ Enable Data-Driven Decision-Making

SMART GOVERNMENT+

Data transparency is key, and Dallas is focused on facilitating this via tools to share information easily with others in the Smart Dallas information ecosystem.

The digital ecosystem in Dallas is focused on facilitating the ease with which the community interacts with City Hall. This includes providing citizens with near real-time access to relevant information and enabling them to conduct interactions with the City on demand and efficiently. The community should have near real-time access to the metrics relevant to them and have a continuous feedback loop regarding how their actions impact the community and how Smart Dallas initiatives impact them. If citizen data is collected, this should be made transparent to the citizens. Data transparency is key, and Dallas is focused on facilitating this via tools to share information easily with others in the Smart Dallas information ecosystem. This includes enabling citizen and community collaboration by nurturing open data principles across the public and private sectors for many organizations in DFW, with the goal of fostering innovation and community participation.

Enabling Smart Government+ includes implementing solutions for smart governance. This includes the digitization and automation of processes within the City to reduce costs and increase the speed of progress. Furthermore, big data and analytics should be used to inform decision-making at all levels of the City's governance, including but not limited to planning, service evolution and policymaking.
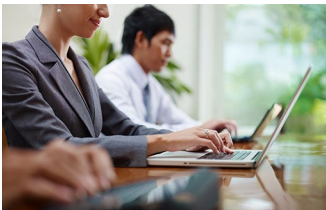
SMART GOVERNMENT+

On-Demand Access

Enable citizens to submit requests and forms digitally and to check on the progress of their requests without having to call a phone number or stand in a line.

Participate in open data exchange with citizens and other organizations to provide on-demand access and visibility to data.

Governance Optimization

Digitize internal and citizen-facing government processes to obtain efficiencies in time, cost and utilization.

Continue to evolve the digitized services to create iterative improvement cycles.

Increase the efficacy and perceived quality of services to improve citizen satisfaction with services provided to them by the City of Dallas.

Data-Driven Governance

Utilize big data analytics and visualization solutions to provide comprehensive, cross-domain insights for use in governance decisions, policy making, planning activities, etc.

Leverage actionable insights to provide the maximum amount of value possible on a constrained budget.

SMART DALLAS — METRICS

The Smart Dallas program utilizes data to generate actionable insights and meaningful results for residents and visitors.

The Dallas Smart City program places a heavy emphasis on accountability and, to this end, is committed to measuring key metrics across all of the Smart Domains. By utilizing data to generate actionable insights, the program can increase the meaningful results for residents and visitors. Smart Dallas Metrics also enable the City to understand the quality of life for Dallasites, understand performance of services and operations the City provides, and improve transparency for both data-driven decision-making and accountability to the public. In each Smart Domain, metrics will be implemented and measured to answer questions in a variety of focus areas.

Smart Mobility+

- **Intelligence of the Transit Ecosystem.** How well does the transportation infrastructure adapt to the changing needs of the transit ecosystem?
- **Safety for Travelers.** How well does the transit ecosystem support safe commute for all travelers and transit modes?
- **Seamless Mobility.** How easy is it for residents and visitors to navigate the Dallas transit ecosystem?

Smart Infrastructure+

- **Availability of Horizontal Enablers.** How much of Dallas has access to key horizontal enablers required for Smart City use cases?
- **Resource Efficiency.** How well do the various types of Dallas infrastructure conserve natural resources such as energy?

Smart Environment+

- **Local Transparency.** How much of the Dallas population has visibility into their local environmental quality?
- **Smart Stewardship.** How intelligent is the management of the City's environment?

Smart Public Safety+

- **Response Rates.** How quickly do public safety services respond when citizens are in need?
- **Public Safety.** How safe is Dallas, and how much visibility do citizens have into safety in their local communities?

Smart Government+

- **Connected Community.** What is the quantity and quality of City services provided via on-demand, digital channels, and how many citizens have access to and adopt these services?
- **Economic Indicators.** How does Dallas fare in providing employment opportunity to residents, and how inclusive is that economy?
- **Citizen Satisfaction.** How satisfied are citizens with the services provided to them?
- **Educational Attainment.** How does Dallas fare in the tech talent race to attract new business investment, and how equitable is our local educational attainment?

SMART DALLAS — SHOWCASE PROJECTS

The majority of Smart City projects go beyond stand-alone systems and technologies to create solutions that cross multiple initiatives and City systems.

The Smart Dallas Roadmap is a plan for implementation of initiatives that meet the objective(s) and goal(s) of one or more Smart Domains. The Roadmap is a living document; the initiatives in the plan are updated periodically, and new initiatives are added. The initiatives currently being planned or delivered can be seen in the milestone chart below.

Showcase Projects

The majority of Smart City projects go beyond stand-alone systems and technologies to create solutions that cross multiple initiatives and City systems, from transportation and energy to education and healthcare. Deploying these kinds of projects requires extensive coordination and an in-depth understanding of how systems, technologies and stakeholder needs fit together. The Smart Dallas showcase projects are some key initiatives that have been done, are currently being worked on or are planned for future deployment.

2018-2019	2019-2020	2020-2021
SMART MOBILITY+ Advanced Traffic Management	SMART MOBILITY+ Smart Parking Beta	SMART MOBILITY+ Multimodal Transit Navigation
SMART INFRASTRUCTURE+ Smart Street Lighting Beta	SMART INFRASTRUCTURE+ Public Wi-FI	SMART INFRASTRUCTURE+ Building Energy Management
SMART ENVIRONMENT+ Environmental Monitoring Beta	SMART ENVIRONMENT+ Smart Irrigation Beta	SMART ENVIRONMENT+ Smart Water Metering
SMART PUBLIC SAFETY+ Next-Generation 911	SMART PUBLIC SAFETY+ Crowd Analytics Beta	
SMART PUBLIC SAFETY+ Camera Surveillance	SMART GOVERNMENT+ Enterprise Asset Management	
SMART GOVERNMENT+ Data Ecosystem		
SMART GOVERNMENT+ Mobile 311		
SMART GOVERNMENT+ Digital Services ePlan		

Figure 5:
Smart Dallas Milestones

SMART DALLAS — SHOWCASE PROJECTS

Domain	Project	Description
Smart Mobility+	Advanced Traffic Management	• This initiative addresses the objectives of dynamic adaptation, intelligent insights and congestion reduction, and commuter safety. • This system improves transportation safety and mobility and enhances productivity using advanced communications, sensors and information-processing technologies. The solution provides value by improving safety and reducing congestion while accommodating the growth of transit.
	Multimodal Transit Navigation	• This initiative addresses the objective of multimodal transit navigation. • This solution provides citizens/visitors a single-point solution that incorporates all modes of transit, including mass transit, car, rideshare, bike-sharing, walking and smart parking solutions.
	Smart Parking	• This initiative addresses the objective of intelligent insights and congestion reduction and is an important input for the multimodal transit navigation objective. • This technology allows for monitoring and predicting availability and provides visibility into available parking options with the potential to locate and reserve parking ahead of time. • Benefits include: – Improved citizen experience – Increased parking utilization rates – Decreased traffic congestion/CO_2 emissions

SMART DALLAS — SHOWCASE PROJECTS

Domain	Project	Description
Smart Infrastructure+	Smart Street Lighting	• This initiative addresses the objectives of energy efficiency and improved infrastructure. • This project includes a beta deployment of street lights converted to LED, and these lights will be managed by intelligent nodes, which allow for remote lighting management, outage alerts and operational efficiencies. Future phases to include additional features such as environmental quality, public safety use cases, etc.
	Building Energy Management	• This initiative addresses the objective of energy efficiency. • This project includes replacement of outdated fixtures with energy- and utility-efficient fixtures. The next phase will include larger system upgrades, such as solar lighting and integrated technology systems, to serve the users.
	Public Wi-Fi	• This initiative addresses the goal of ensuring equitable access to economic growth and the objective of improved infrastructure. • This initiative includes implementation of free Wi-Fi in certain public spaces to provide internet access, with a focus on disadvantaged communities. Free public Wi-Fi is currently available in 80+ City facilities throughout Dallas, such as libraries, recreations centers, outdoor parks and public office buildings. The current pilot is being implemented in the Dallas West End. This communication infrastructure could also be used horizontally to support other Smart City use cases.

SMART DALLAS — SHOWCASE PROJECTS

Domain	Project	Description
Smart Environment+	Smart Water Metering	• This initiative addresses the objective of smart water management by providing near real-time information on customer service agents water usage. • This solution allows Dallas Water Utility to effectively manage conservation initiatives, improve metering accuracy and operate more efficiently. Approximately 7 percent of the water system is being served with intelligent meters.
	Water Quality Monitoring	• This initiative addresses the objective of localized environmental quality visibility. • This solution includes technology sensors that provide real-time, 24/7 information about the City's water supply, alerting Dallas Water Utility (DWU) to possible water quality issues or contamination before water reaches a tap in Dallas. This ensures that citizens can enjoy clean and safe water.
	Smart Irrigation	• This initiative addresses the objective of smart water management. • Intelligent irrigation monitoring measures and manages water usage, watering schedules and determines the amount of water necessary to care for the specific vegetation present at the site.
	Environmental Monitoring	• This initiative addresses the objective of localized environmental quality visibility. • The environmental monitoring pilot will focus on monitoring environmental status, such as air quality, urban heat island intensity, etc. Environmental sensors measure different types of pollutants, temperature, air quality (including ozone and CO_2) and particulates (allergen levels). This data/information will be incorporated into public health initiatives, such as school absenteeism, EMS and alert levels.
	Solid Waste Management	• This initiative addresses the objective of waste reduction and will provide transparency regarding the intake, processing and reuse of recycled goods in our community. • Zero Waste is a philosophy and design framework that not only promotes reuse, recycling and conservation programs, but also, and more importantly, emphasizes sustainability by considering the entire life cycle of products, processes and systems. This pilot focuses on improved metrics and transparency for the Dallas solid waste management programs.

SMART DALLAS — SHOWCASE PROJECTS

Domain	Project	Description
Smart Public Safety+	Camera Surveillance	• This initiative addresses the objective of data-driven policing. • By combining information from video surveillance cameras, social media and citizen reports, the solution provides a more comprehensive view of urban safety—helping law enforcement monitor public areas/high-crime areas, analyze patterns, and track incidents and suspects.
	Crowd Analytics	• This initiative addresses the objective of data-driven policing. • Future phases of camera surveillance could include crowd metrics tracking. Crowd analytics can be used by public safety officials to detect anomalies.

	Next-Generation 911	• This initiative addresses the objective of intelligent emergency response by having a 911 system with the highest resiliency level and latest features.
		• Upgrade the City of Dallas' 911 Call Center technology to a digital system with a fully redundant back system.
		• Key benefits are:
		  – Increased reliability of 911 network
		  – Improved information for first responders and public access to 911 (text, data, photos and videos)
		  – Transfer of 911 activity/calls between geographically dispersed 911 call centers

SMART DALLAS — SHOWCASE PROJECTS

Domain	Project	Description
Smart Government+	Open Data Ecosystem	• This initiative addresses the objective of community engagement and data-driven governance. • These solutions focus on data transparency, and open data enhances collaboration, participation and social innovation. These data analytics and sharing technologies empower the use of data and transform the way the City of Dallas works using data. This entails use of data to continuously improve City services and operations and provide transparency and accountability, including information about City activities, such as the Bond Program, with up-to-date information about project functions, timelines and expenditures. Published data supports broad and unanticipated uses of City data and supports trust, transparency and accountability.
	Mobile 311	• This initiative addresses the objective of on-demand access. • The Mobile 311 solution is an on-the-go mobile app providing access to City services. Information and photos provided allow City departments to efficiently assess, prioritize and respond to requests. A natural language–powered virtual assistant enables customers to speak their own words and uses natural dialogue that mimics a live agent interaction, which eliminates navigation complexity and results in a faster, more direct path to resolution. This project replaces the current legacy 311 system with a modern Customer Relationship Management (CRM) solution.
	Digital Services—ePlan	• This initiative addresses the objective of on-demand access. • The ePlan solution supports a seamless process for document submission, permit application, plan review and approval, and permit issuance—speeding the process significantly. – Enables a fully digital permit application and plan review process. – Reduces the time to permit through replacing the old paper-based sequential plan review process with an electronic-based simultaneous plan review system.
	Enterprise Asset Management	• This initiative addresses the objective of governance optimization. • This project eliminates duplicate and legacy systems and standardizes the City's asset management into a single modern system for critical assets across the entire organization.

SMART DALLAS — PROGRAM MODEL

An operating model for the Smart Dallas program will be utilized that will enable delivery of seamless, efficient and effective services to the citizens of Dallas.

The City of Dallas has 40+ departments and many stakeholders depending on the Smart Dallas program's effective and efficient implementation, including the citizens and businesses that call Dallas home. To facilitate expeditious, successful results, an operating model for the Smart Dallas program will be utilized that will enable delivery of seamless, efficient and effective services to the citizens of Dallas. The City of Dallas is organizing the City departments and our partner ecosystem into an operational structure designed for success in the Smart City arena. There are several components in the ecosystem and operating model seen below—primarily the City Operation and Governance Model, the Ecosystem and Partner Structure and the Community Inclusion Initiatives—which are all centered around the Citywide, cohesive technology and data approach discussed in the Smart Dallas Technology Principles section.

City Operation & Governance	Ecosystem & Partner Structure	Community Inclusion Initiatives
• Cross-department collaboration with IT at the center • Central technology strategy and framework • Common Smart City data strategy, governance and platform	• Three-tiered partnership structure • Multiple anchor partners to ensure best technology and solutions for Dallas citizens • Streamlined procurement process	• Outreach and education programs • Hackathons and local entrepreneur engagement • Smart City training and job opportunities across Smart City initiatives

Figure 6: Program Model

SMART DALLAS — PROGRAM MODEL

The City Operation and Governance Model is structured to promote utilization of the horizontal technology and data enablers to realize Smart City use cases across all domains and departments.

The City Operation and Governance Model is structured to promote utilization of the horizontal technology and data enablers to realize Smart City use cases across all domains and departments. This is accomplished via a central Communication and Information Services (CIS) department which provides technology and data services and framework to realize Smart City use cases. Each department is addressing different use cases and challenges for which quality effective solutions are required, and CIS utilizes the horizontal technology and data framework enablers to provide those solutions efficiently. Given the complex nature of stakeholders, business partners and vendors, effective and efficient operation hinges on having a clearly defined decision-making framework—the City has a clearly defined governance process for initiative prioritization and delivery with which the Smart City program decision-making hierarchy is aligned.

City Operation & Governance Model

- Clearly Defined Decision-Making Hierarchy
- Established Governance Process for Initiative Prioritization and Delivery
- Centralized Smart City Vision and Roadmap
- Citywide, Cohesive Technology and Data Approach

Figure 7: City Operation & Governance Model

SMART DALLAS — PROGRAM MODEL

The Smart Dallas program execution process is iterative and flows from the Initiative Prioritization phase through Initiative Implementation and Metrics to culminate in the Business and Operational Model + Citizen Impact Evaluation. The Smart Dallas program will be executed pursuant to the City of Dallas' currently adopted IT governance process. Based on the City's prioritized list of initiatives, pilot or beta projects will be created with the key purpose of proving out the business and operating models of the solution in a small- or medium-scale deployment. The outcome of the pilot or beta project should be a clear business and operating model for scaling out the solution across larger portions of the City and clear, measurable citizen impact metrics. Not all Smart City pilots and betas will be funded by the City of Dallas; however, those led by partners and vendors are encouraged to provide a report at the culmination of the pilot describing the outcome, including the metrics and business case for larger-scale deployment.
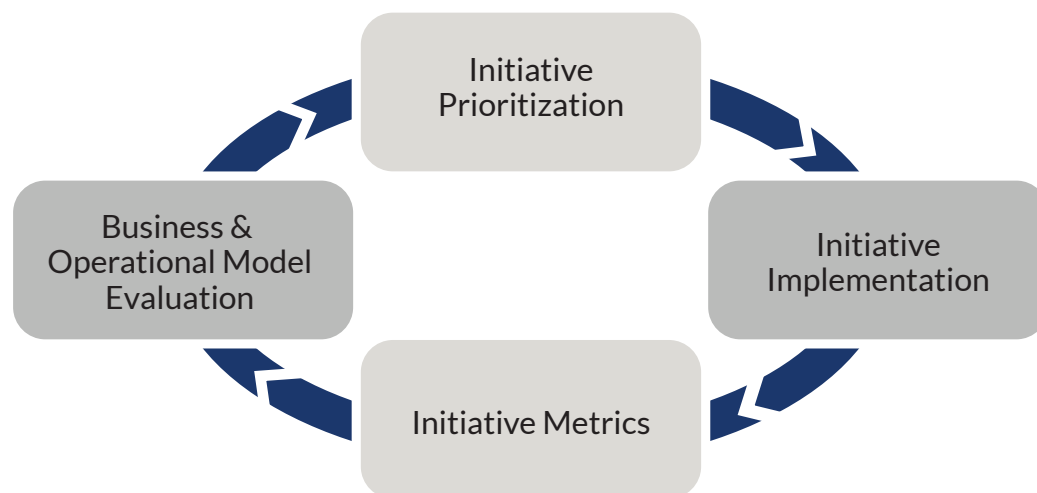
Figure 8: Smart Dallas Program Execution Process

Smart Dallas Funding Options

The City of Dallas is actively pursuing a variety of avenues for funding of Smart City initiatives. Potential funding sources from a variety of grant types have been identified across all five Smart Domains. The potential to leverage private funding via Public–Private Partnerships is a well-established mode of funding in Dallas Smart City ventures thanks to the Dallas Innovation Alliance. Dallas is also exploring the option of self-funding projects for which the gain in cost-efficiencies or revenue is higher than the cost to implement and maintain the solution. And finally, leveraging some of the general funds is a potential avenue to supplement the aforementioned funding options.

SMART DALLAS — PROGRAM MODEL

The Smart Dallas program approaches delivery of initiatives by leveraging horizontal enablers for technology and data. The City of Dallas sees the technology, processes and infrastructure necessary for implementation of Smart City initiatives as horizontal enablers utilized to provide services across all Smart Dallas goals, challenges and domains as depicted below in Figure 6. Since each enabler can be utilized across all Smart Domains, Dallas can take advantage of delivery and maintenance efficiencies, ensure implementation based on the City's best practices, and provide enriched services to citizens beyond what is feasible to provide individually.
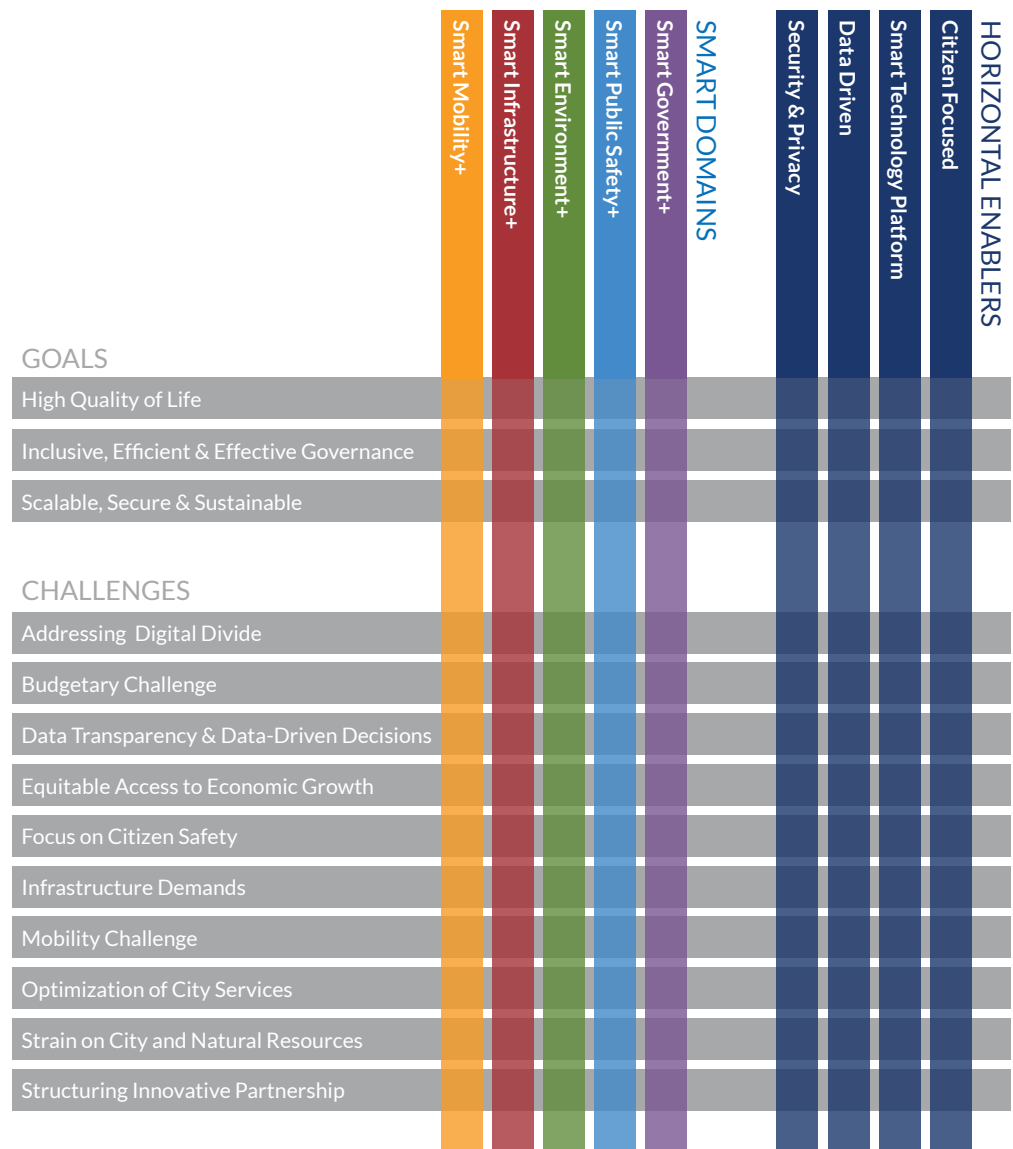
Figure 9: Smart Dallas Model

SMART DALLAS — ECOSYSTEM AND COMMUNITY INCLUSION INITIATIVES

The Ecosystem and Partnership structure is anchored by the City with a flexible partnership model to enable entities to join the City's Smart City journey at the level that fits their objectives and needs. Whether an entity is an Anchor, Partner or Member of the Smart Dallas Ecosystem, all who participate focus technology and innovation on the Smart Dallas efforts in pilot areas and larger Dallas footprints.
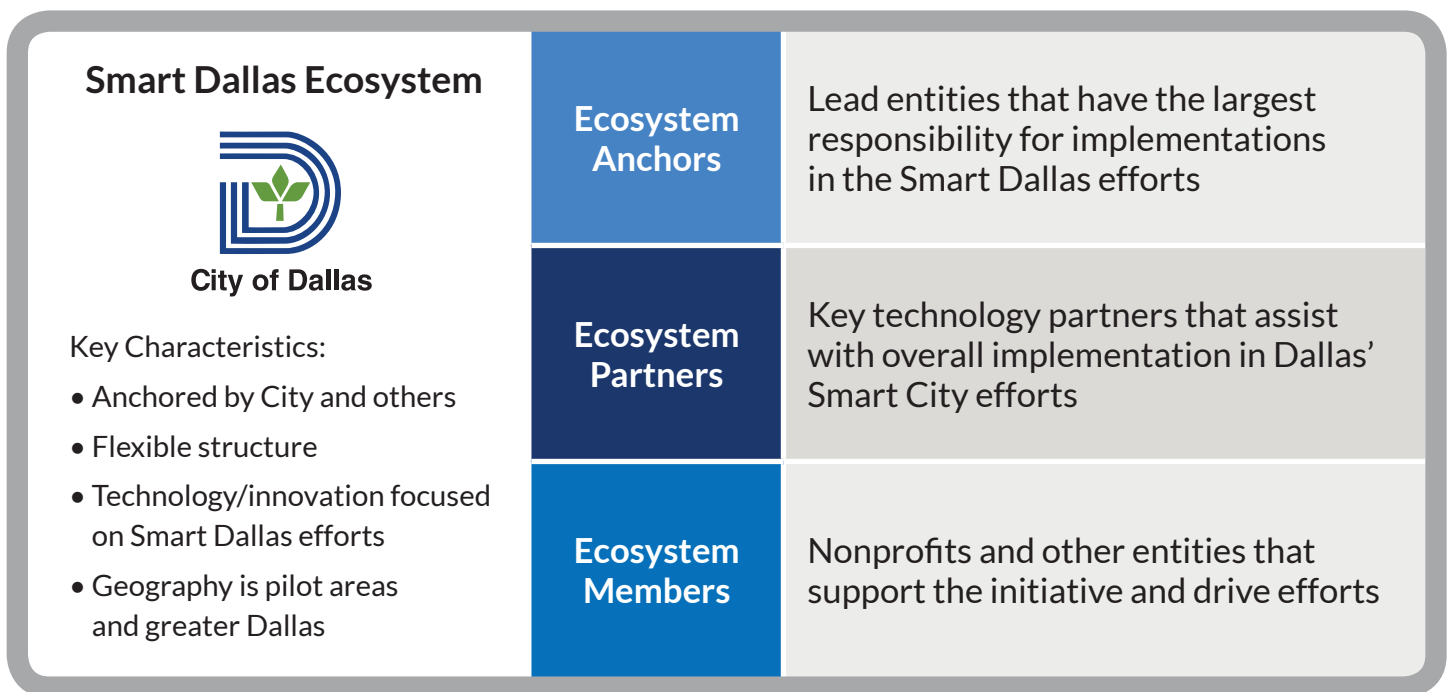
Smart Dallas Ecosystem

City of Dallas

Key Characteristics:

• Anchored by City and others

• Flexible structure

• Technology/innovation focused on Smart Dallas efforts

• Geography is pilot areas and greater Dallas

Ecosystem Anchors	Lead entities that have the largest responsibility for implementations in the Smart Dallas efforts
Ecosystem Partners	Key technology partners that assist with overall implementation in Dallas' Smart City efforts
Ecosystem Members	Nonprofits and other entities that support the initiative and drive efforts

Figure 10: Smart Dallas Ecosystem

Community Inclusion Initiatives

Central to all Smart Dallas efforts is an emphasis on community inclusion efforts that are driven by outreach programs, hackathons and entrepreneur engagement, as well as Smart City training and job opportunities. The City and its Smart City Ecosystem lead continuous technology outreach and educational programs throughout the year, as well as citizen engagement initiatives specific to individual Smart City programs. Smart City initiatives in Dallas are encouraged to include education and job opportunities for Dallasites to increase the level of local talent. Utilizing citizen engagement initiatives to garner input into the Smart City creative process is one avenue of citizen inputs to the Smart Dallas feedback loop.

SMART DALLAS — EARLY INNOVATIONS

Smart Dallas Pilot—Arts District

Dallas' first Smart City deployment was in June 2014 at the Arts District in Dallas. This collaborative effort between the City and business partners resulted in an interconnected platform that enhanced the City's ability to provide innovative services. The Dallas Arts District, the largest urban arts district in the country, was selected as the Smart City test bed based on the diversity and level of possible human interaction. Since then, pilots have been established in the West End, and a beta deployment is currently in the pipeline.

Smart Dallas Pilot Program— Arts District

- **Launched June 2014:** The common infrastructure supported multiple City services, such as citizen-accessible information kiosks, district Wi-Fi, citizen connectivity, video surveillance and improved public safety. City services that operate on the same City network include water meters, leak sensors and parking meters.

- **Purpose of the Smart Dallas Pilot:** The purpose is to capture results for use cases, including energy and water efficiency, environmental health, citizen engagement, parking management, etc.

Smart Dallas Program

The Smart Dallas program is led by the City of Dallas and utilizes an ecosystem of partners and the citizens themselves to formulate and implement large-scale Smart Dallas initiatives. Pilots such as the Arts District described here and the West End described on the next page provide insight and experience with smart technologies and citizen needs and benefits prior to implementation. The Dallas Innovation Alliance (DIA) is one of the partners in the Smart Dallas ecosystem and has led the West End Living Lab pilot described on the next page.

SMART DALLAS — EARLY INNOVATIONS

Smart Cities Living Lab in the West End

Why the West End Historic District? The West End is the birthplace of Dallas and in the midst of revitalization as an innovation district. It represents a microcosm of the urban environment, encompassing retail and restaurants, offices, municipal buildings, education facilities, museums and fast-growing residential. It houses Dallas Area Rapid Transit's (DART) most heavily trafficked light rail and bus stations in the system. It is a hub of startup activity via the Dallas Entrepreneur Center. The Smart Cities Living Lab in the West End is the **fastest-to-market Smart City initiative in the country**, from concept to launch in 10 months. Results will provide a proven approach to larger Dallas initiatives.

Phase 1: West End Living Lab	• **Launched March 2017:** A fully integrated pilot made up of nine projects in a four-block corridor on Market Street in the heart of the Dallas Innovation District. It is the fastest-to-market Smart City initiative in the country. • **Purpose of the Living Lab:** The purpose is to capture results and provide a case study and recommendations for use cases, including energy and water efficiency, environmental health, citizen engagement, parking management and neighborhood revitalization.

Dallas Innovation Alliance

The Dallas Innovation Alliance (DIA) is a public–nonprofit partnership between the City of Dallas and DIA (a 501(c)(3) organization) focused on creating a living lab in Dallas' historic district (West End) that is piloting/leveraging smart technology to improve the intersection of community, technology and data solutions to facilitate sustainable growth, increase efficiency and, importantly, improve the quality of life. The DIA in partnership with City leadership was launched at the White House in September 2015 as part of the Office of Science and Technology Policy announcement of federal Smart City initiatives. Currently, the DIA has nearly 30 partner organizations across the public, private, civic and academic sectors and has worked with over 20 City departments. The partnership has working relationships with nearly 40 cities around the world.

# SMART DALLAS — TECHNOLOGY PRINCIPLES

Central to the Smart Dallas approach are the principles of a citizen-focused, data-driven, smart-technology platform, and security and privacy – the overarching principles described in Dallas' Technology+ Strategic Plan.

1. Citizen Focused

Communication with the citizens is a continuous feedback loop, and citizens have visibility into how their actions impact their communities. In Smart Dallas, the City dynamically adapts to the needs of the citizens so this understanding of the citizen sentiment is key. All Smart Dallas initiatives have a focus on the impact for the citizens.

2. Smart Technology Platform
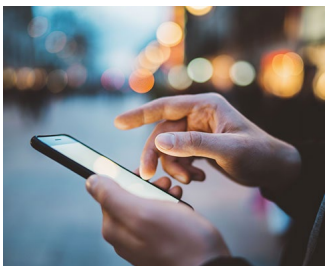
Smart Dallas solutions are implemented based on open and interoperable standards wherever possible – enabling evolution to changing market requirements and the ability to meet the diverse needs in different communities across Dallas. This also supports leveraging the existing assets to the fullest extent possible. The Smart Dallas program should have a program-wide roadmap and any synergies that can be should be leveraged cross initiatives to reduce the cost to provide the value to the citizens. Leveraging existing assets to maximize the value of previous investments is key to this guideline.

3. Data Driven

All Smart Dallas initiatives should consider availability and access of data to enable cross-initiative insights and easy-to-implement visibility for citizens. Data should be accessible and follow the Smart Dallas Data Management guidelines. Solution for data should avoid data lock-in and ensure interoperability with other government organizations locally and globally, where possible.

4. Security & Privacy

All Smart Dallas initiatives should utilize the Security and Privacy Frameworks, and citizens should have visibility into how their private information is being treated.

Dallas' Technology+ Strategic plan: http://dallascityhall.com/departments/ciservices/DCH%20Documents/City-of-Dallas-Technology+StrategicPlan.pdf

ACKNOWLEDGEMENTS

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