Smart City Strategic Plan

City of Ann Arbor, MI

A Digital Transformation

Smart Infrastructure

Smart Public Safety

Smart Building

Connected Vehicles

Smart Lighting

Smart Transportation

Smart Parking
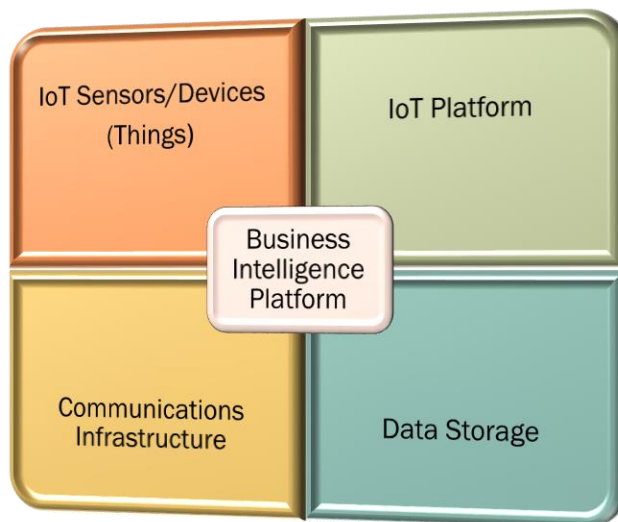
Environmental Sensors

Contents

What is a Smart City?

"A smart city utilizes modern technology and the collection of data to maximize operational efficiency, reduce costs, and enhance how we serve our community"

The rise of the Digital Revolution and the Internet of Things (IoT) has made it possible to connect critical infrastructure assets such as street lights, parking meters, trash and recycling bins, environmental sensors, water pipes, sewer pipes, etc. to the city's communications infrastructure (fiber optics, wired, or wireless networks), the web/cloud, or cellular network. Today, connected assets can be monitored and controlled remotely, and report critical data that can be utilized to make informed business decisions that can lead to innovation, operational efficiencies, cost savings, and economic development.

A smart city solution is comprised of the following elements. These elements are highly interactive, dependent on each other, and must be treated as a system in order to be a truly effective smart solution.

✓ **IoT Sensors/Devices (Things)**
Digital or electronic sensors or devices, connected to city assets such as street lights, water meters, trash bins, parking meters, etc.

✓ **Communications Infrastructure**
The city's fiber optic, wired, or wireless network, the web/cloud, or a cellular network (Verizon, Sprint, T-Mobile, etc.) that IoT sensors/devices are connected to.

✓ **Data Storage**
Storage located in the city data center or the cloud that stores information generated and captured from the IoT sensors/devices. The data is stored in the city Storage Area Network (SAN) or in the cloud where it can be utilized and analyzed in real-time or in the future.

✓ **IoT Management Platform**
Software specific for the remote monitoring and the management of IoT sensors/devices. The software can proactively address issues, report on the health, and provide data for a IoT sensor/device.

✓ **Business Intelligence (BI) Platform**
Aggregates and integrates data collected from city assets in a central location so data science and advance analytics can be applied. Dashboards and visualizations can be produced and provided to city business units for data-driven decision-making or for public consumption.

What Does A Smart City Look Like?

IoT Sensors/Devices (Things)

Imagine *environmental sensors* are strategically placed throughout the city that could report CO_2 emissions, temperature, pollution, and toxic gases, and rainfall data. Buildings could be equipped with *smart automation systems* to control operations, report energy usage, and provide advanced notification to Safety Services in the case of an emergency. *Video cameras* could monitor parking

spaces and utilize *machine learning* and *artificial intelligence* to capture parking capacity and consumer tendencies. *Connected vehicles* could communicate with each other and the communications infrastructure, to improve safety and shorten travel times. *Signal preemption* on traffic signals could expedite emergency vehicle response or transit on-time performance. Remotely controlled *Smart lighting* could facilitate public safety emergencies or community events or be programmed to reduce energy. IoT sensors could be placed on *storm sewers* to control discharge into our rivers based on the amount of rainfall. *Smart kiosks* could be placed throughout the downtown for visitor information and messages that could be changed in real-time.

The above are just a few examples of the capabilities current technology has made possible.

2021
35 Billion
IoT Devices

2019
26.66 Billion
IoT Devices

2020
31 Billion
IoT Devices

2025
75 Billion
IoT Devices

2018
7 Billion IoT
Devices
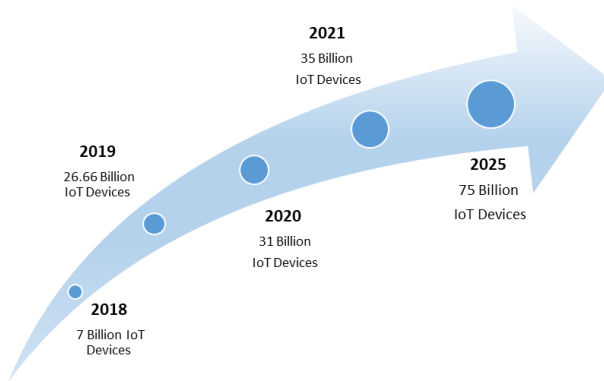
In 2018, there were 7 billion active IoT devices (Things). In 2019, the number of active IoT devices reached 26.66 billion. Every second 127 new IoT devices are connected to the web. During 2020, experts estimate the installation of 31 billion IoT devices. By 2021, 35 billion IoT devices will be installed worldwide and by 2025 more than 75 billion IoT devices will be connected to the web. (Maayan, 2020)

Communications Infrastructure

Connecting thousands of IoT sensors/devices require a dense and robust *communications infrastructure*. The city and private industry provide a variety of fiber, wired, and wireless communications networks to accommodate future connectivity needs.

Connecting current and future city assets provide the following key benefits over traditional non-connected assets:

Real-time Operation, Remote Control, and Monitoring of Smart Assets

IoT management platforms/applications are utilized to remotely monitor and control IoT sensors/devices from anywhere an internet connection can be achieved. The status and health of the asset can be viewed or reported in real-time and allow for immediate or proactive resolution to an issue or problem. For example, if a smart streetlight failed, it would immediately notify the system (IoT Platform) of the outage so maintenance could be scheduled. Currently, if a failure occurs it must be identified for repair by city staff or passersby. This results in a Cityworks or A2 Fix It request, and requires additional city resources to resolve the issue.

In the case of a smart streetlight, the *IoT management platforms/application* can also be utilized to program one, or all, streetlight functions based on time of day, traffic, weather, etc. and can be remotely re-programmed at any time. In addition, software can be developed to automate the routing of service calls based on issues captured over a period of time. Traditionally, lighting modifications required manual changes and automation was limited to photocell technology and streetlights were not connected to a communications network.

Data-Driven Decision Making

Unlike traditional city infrastructure assets, smart assets are connected to a communications network and report data on their status, operation, and health. This *data* is stored in the *cloud* or on the city's *storage area network (SAN)*. In conjunction with *data sciences* and the city's *Business Intelligence (BI) Platform* (aka "Big Data"), data captured from all assets can be analyzed, visualized, and provided back to city employees to aide in solving business problems, performing cost analysis, budgeting, operational performance, and informing the community. Possessing data generated from

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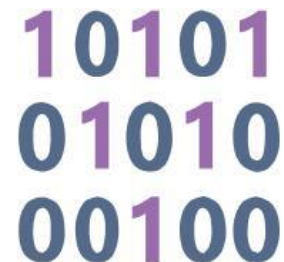
connected assets promote a *data driven culture* and provide the *knowledge* needed to enhance the delivery of exceptional services to our community.

A Connected Smart City Ecosystem

A smart city is only as good as its foundation. Over time, the city has strategically implemented the key foundational components (fiber, conduit, data storage, networking, security, BI platform) in coordination with other city capital projects. The city's systems can support a long and sustainable smart city ecosystem capable of connecting city assets and devices. As with any system, the foundation is only as strong as its weakest link. Our smart city ecosystem must be treated as a highly integrated system and all elements must work together in order to be successful.

Executive Summary – A Digital Transformation

The evolution of digital technology and the Internet of Things (IoT) has given the City of Ann Arbor the opportunity to reshape, transform, and elevate the way the city operates and serves its community. The City of Ann Arbor Smart City Strategy will address how we leverage advances in technology to improve city operations, more efficiently use city resources, utilize data to make more informed business decisions, solve city and community problems, and provide exceptional services to our community.

Today, through the deployment of smart devices/sensors or IoT devices (Things), we have the capability to connect city infrastructure assets to the city network. Connecting these assets allows for the remote management, monitoring, and the collection of data that was historically not feasible. The more infrastructure assets we are able to connect, the more we will enhance our ability to serve our community, and in a more efficient and effective manner.

> "smart cities' spending on technology in the next six years is expected to expand at a compound annual growth rate of 22.7%, reaching **$327 billion by 2025** from $96 billion in 2019" (StateTech Magazine, 2020)

Many smart city solutions have already been implemented by the city such as smart water meters, smart trash and recycling bins, and smart lighting. Over the past few years, in preparation for smart city solutions, the IT department has made significant improvements to the city's fiber optics communications network and technology infrastructure, and has implemented a Business Intelligence (Big Data) platform. These systems are the foundational building blocks needed to support any successful smart city ecosystem.

The COVID-19 pandemic has been challenging for all, but has brought to light how technology can allow us to perform our jobs and maintain services to the community. It has proven teleworking is viable and that many employees can be just as productive when working from home. Smart city solutions make it possible for workers to manage city assets from anywhere you can achieve a reliable and secure internet connection.

Smart City Strategic Planning Meetings

The city conducted two strategic planning meetings with city departments and community stakeholders consisting of the City of Ann Arbor Service Areas, City of Ann Arbor City Administration, DDA, University of Michigan, AAATA, SPARK, LDFA, and Washtenaw Community College. In addition, two community meetings were conducted with the public. The results of these meetings can be found at Smart City Strategic Planning Results.

Participants in the meetings responded to a series of questions and feedback was solicited to identify desired characteristics of a smart city, how community problems can be solved, how the standard of living can be improved, the value of a smart city to the community, and challenges that should be considered or addressed. A gallery walk was conducted in the city/community stakeholder meetings and responses were categorized, voted on, and tallied based
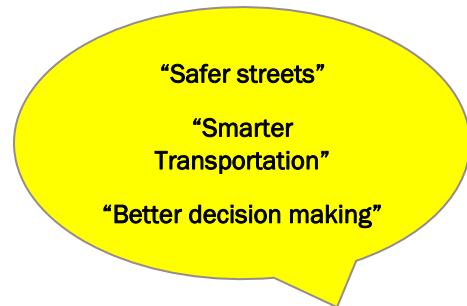

"Flexible"

"Resilient"

"Measurable Impact"

Main Characteristics of a Smart City?

on the highest number of responses. These results were coupled with feedback from the public in our community meetings and resulted in the following themes:

- ✓ The *main characteristics* of our Smart City Strategy should possess strong partnerships and sharing. It needs to be flexible and adaptable, equitable, sustainable, and data driven.
- ✓ The main *community problems* our Smart City Strategy should address is to eliminate social problems and improve the environment, city services, public safety, and parking.
- ✓ To *improve the standard of living* in our community our Smart City Strategy should promote economic development, safety, city services, and produce reliable and transparent data/information.
- ✓ The *value* of a smart city to the community is to improve city services, improve infrastructure, economic diversity, and economic development.
- ✓ The main *barriers and challenges* a smart city will encounter are political, legal, fear of change, privacy, security, shared vision, prioritization, sustainability, and safety.

"Equity of service delivery"

"Mobility for all"

"Environmental quality"

"Economic diversity"

What community problems should a Smart City Strategic Plan address?

"Safer streets"

"Smarter Transportation"

"Better decision making"

Improve the standard of living and economic opportunities?

Main Strategic Goals

As a result of the planning meetings and the feedback, the following *main goals* for the City of Ann Arbor Smart City Strategic Plan were established and are explained in greater detail later in this plan.

The Most Desirable City to Live, Work, and Play

Improve the Quality of Life

Build and Maintain A Modern, Innovative, and Sustainable Smart City Ecosystem
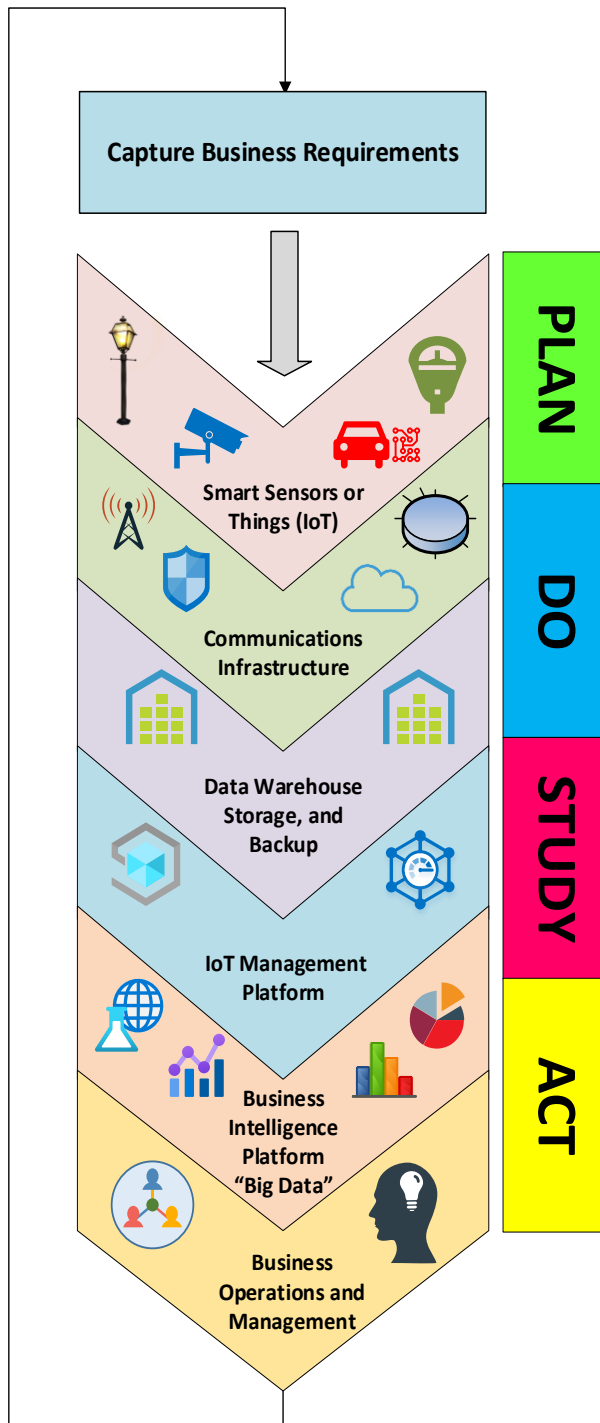
Figure 1

Our Approach

Our approach is to organically grow our smart city ecosystem in order to solve community problems, improve the service we deliver to the community, and enhance city services. To achieve the goals stated above, our smart city strategy must be community focused, holistic, and align with strategies and best practices set forth by our organization such as the City of Ann Arbor Strategic Plan, A2Zero, Vison Zero, Complete Streets, One Community, the Information Technology (IT) Department Technology Plan, Cellular Strategic Plan, and Priority Based Budgeting (PBB), etc. In order to be successful, the design and implementation of our smart city ecosystem must be treated as a system of highly interactive components, must remove traditional community and organizational barriers and silos, and instead, converge and create synergies.

A true smart city environment is very complex and comprised of numerous moving parts that are constantly evolving. Many of the foundational components required for a successful smart city have already been implemented, which significantly reduces future capital expenditures for the city as well as the community. Possessing a strong communications infrastructure removes a significant barrier and will increase the success of future smart city solutions.

The design, planning and implementation model in *figure 1* will be utilized to ensure all elements of a smart city are taken into consideraton as opportunities present themselves, and continuous improvement is designed into solutions utilizing a PLAN-DO-STUDY-ACT framework and the IT department Project Delivery Methodology.

As the city addresses opportunities to remediate, replace, or implement new infrastructure, sustainability and equity requirements must be taken into consideration. The ability to connect city infrastructure assets to the city network allow us to remotely monitor the health of each asset to determine their status, thus allowing us to respond proactively to outages, problems, or maintenance needs in an equitable and inclusive manner.

Summary

The digital revolution allows us to accomplish things previously not feasible. Our smart city pursuit is a journey, will never end, must be realistic and achievable, and will evolve over time. The opportunities are endless, and it is imperative we build smart solutions intrinsically into our DNA so we can continue to serve our community at the highest level.

Goal 1: The Most Desirable City to Live, Work, and Play

Our Smart City strategy and infrastructure is designed to support next generation systems and facilitate enhanced city services such as transportation, mobility, housing, community services/parks, parking, the arts, festivals, parks and other leisure and cultural events in order to make Ann Arbor the most desirable community to live, work, and play.

Ann Abor is unique in the way its critical infrastructure is managed and operated. The City Transportation Department operates traffic signals, public transportation is operated by the Ann Arbor Area Transportation Authority (AAATA), electricity and lighting are primarily provided by DTE, parking is the responsibility of the Downtown Development Authority (DDA), and the University of Michigan Transportation Research Institute utilizes the city's fiber network for conducting connected vehicle research. This hybrid model poses unique challenges and requires effective collaboration, communications, and strong relationships.

Objective: Enhanced City Services

Efficient city services are crucial to any community. The city has already deployed and embraced smart city solutions such as our smart water meter system, Automated Vehicle Location (AVL) system for city vehicles, and smart trash and recycling bins. Smart city concepts apply to any infrastructure assets that can accommodate a smart sensor such as the tagging of assets, water pipes, sewer pipes, river water flow sensors, storm water basins, parking meters, environmental sensors, etc. As new opportunities arise, existing smart city solutions will be expanded, and new opportunities pursued to enhance services provided to the city and the community.

Following are actual or potential smart city use cases the city is currently pursuing or could potentially pursue as opportunities arise:

Smart Street Lighting

Work is already underway to implement 70+ smart streetlights in the downtown area. The smart streetlight heads allow us to remotely monitor, control, and capture health data about each light. Issues with streetlights can be proactively determined in advance to mitigate the chance of a problem or an outage. Smart streetlight heads have the capacity to install additional modules to accommodate other smart city solutions such as: public or private wireless network, the ability to detect pedestrian traffic via cell phone signals, or connecting the city's fiber that would allow us to connect cameras or environmental sensors.

Snow/Rainfall/River Water Flow/Water & Sewer Pipes/Storm Water

Sensor technology can be utilized on our roads, in our rivers, and on city infrastructure assets to determine amounts of rain or snow, water flow, health or issues with water pipes, and the amount of storm water being discharged into our rivers. Data captured from these assets, coupled with software applications, can proactively sense problems before they occur or automate the routing of city resources to address and resolve issues or scheduled maintenance.

Smart Asset Tagging

City assets can be tagged with sensors to track/locate equipment, prevent loss, and improve safety. City assets such as rental kayaks or canoes can be automatically located in the case of an emergency or inclement weather, or inventoried at the end of the day thus eliminating manual labor currently utilized.

Smart Parking and Curb Management

Parking can be enhanced through the use of Artificial Intelligence (AI) and Machine Learning. Sensors and cameras can be strategically placed to monitor parking spots and determine parking tendencies without compromising privacy. The information captured can be used to determine parking capacity, change rates in real-time based on availability, provide real-time parking information for city visitors, provide intelligent curbside management, or route people to available parking spots. The city and the Downtown Development Authority (DDA) are working together to connect all city owned parking structures/lots in the DDA District and will provide the DDA with ample capacity to implement technology and future smart city solutions.

Smart Downtown Ann Arbor/Technology Park

A project is currently in progress to densify the city's communications infrastructure in the DDA District to accommodate future smart city solutions designed to

promote an innovation district, attract and retain people and businesses, and facilitate enhancing the vibrant downtown experience. Solutions such as connected intelligent kiosks to provide visitors with information and aide in navigating the city, digital signage/marquise/message boards, EV charging stations, public/private wireless networks, dark fiber access, parking sensors, electronic parking bollards, audio speakers, in-ground lighting, etc. could be considered.

Objective: Smart Transportation/Mobility

People should be able to move efficiently and safely through our community utilizing multi-modal transportation. Our transportation system must be truly seamless and integrated. It must capture data, both scheduled and on-demand, from all mobility sources to facilitate informed decision making. It must support the city's Vision Zero, Complete Streets, carbon neutrality, and equity goals.

Public and private organizations require a solid communications infrastructure that can accommodate the capacity needed for implementation of new and future technology to improve mobility, increase accessibility, reduce emissions, and improve safety. The infrastructure that supports the city's current transportation/mobility needs and the University of Michigan Transportation Research Institute (UMTRI) is aging and requires upgrades. New projects are currently in progress to densify our fiber and conduit in the city to support robust mobility corridors in order to maintain our position as the leader in connected vehicle and infrastructure research, transportation, and mobility.

Objective: Promote an Innovation District

Businesses and our community need people and technology resources to accomplish their goals and thrive. This smart city strategy is designed to further position the City of Ann Arbor as the elite and most desirable smart city "playground," Technology Park, and Innovation District in the country. Access to affordable high-speed communications infrastructure capable of supporting our business startups/incubators, teleworking, distance learning, and smart city initiatives are key to attracting and retaining talent and businesses to our area. The city will continue to expand our communications infrastructure to promote competition and choices for affordable high-speed broadband access for our community for many years to come. We will work with key community stakeholders to ensure they have knowledge of the city's infrastructure availability and capabilities so they we can take full advantage of this very valuable asset.

Objective: Promote Smart Affordable Housing

The city IT department works very closely with the Ann Arbor Housing Commission and their business/technology needs in order to align with their mission. As new sites are constructed and remediated, smart building automation systems will be considered to gauge indoor air quality, reduce energy consumption, increase safety and security, reduce costs, and increase efficiency. Each housing facility is connected to the city's network and has access to high-speed broadband and excess fiber for future connectivity needs.

Objective: Bridge the Digital Divide

The COVID-19 pandemic has demonstrated the reliance and need for quality high-speed broadband access. A key design consideration for our communications infrastructure is to make it easily accessible to our public schools and community so we can further bridge the digital divide and facilitate reliable and equitable distance learning and teleworking. We will continue to build in excess capacity into our communications infrastructure and market the use of our fiber networks to public and private entities to promote competition, equality, choices, affordability, and access to high-speed broadband access.

Goal 2: Improve the Quality of Life

Smart City solutions must be inclusive, transparent, accessible, environmentally friendly, and equitable to improve the quality of life in our community. Smart city solutions must be designed to reduce crime, improve health, improve the environment and solve community problems and have a positive impact on people's lives.

A strong smart city ecosystem will remove traditional barriers and facilitate for a safer, healthier, and environmentally friendly community.

Objective: A Safe Community

Our community wants to feel safe and smart city solutions can be considered to increase safety. For example, signal preemption can be implemented to open faster routes to hospitals; video cameras and drones can be used to get a visual at the scene of a crime or fire prior to the arrival of first responders so initial conditions can be assessed; Artificial Intelligence can mitigate crime or

anticipate large crowds on-demand; smart street lighting can be remotely monitored and controlled on-demand; gun-shots can be detected and automatic notification can be sent to police as they occur utilizing Ring systems for 2-way video communications between citizens and Safety Services. The data collected from connected smart devices can be fed to crime mapping applications for analysis, and existing body worn cameras and in-car camera systems for Police can be enhanced by allowing real-time upload of videos.

A smart and robust communications infrastructure is necessary for seamless communications among first responders, Safety Services, health care organizations, and other community members in order to improve communications, response, and safety.

Objective: A Healthy and Environmentally Friendly Community

Our smart city strategy will facilitate and support the city's A2Zero Climate Action Plan in order to achieve the community's carbon neutrality goals. As the city implements A2Zero, our robust communications infrastructure is available for, but not limited to, the implementation of building energy management systems, indoor/outdoor air quality sensors, and electric vehicle (EV) chargers.
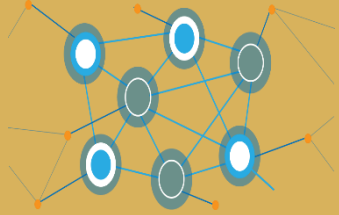
Strategically placing environmental sensors around the city can detect CO_2 emissions, temperature, pollution, toxic gases, and rainfall amounts. New Electric Vehicle (EV) charging stations can be connected in order to remotely manage EV stations and collect data for energy cost optimization and energy usage.

Data captured from these devices can be utilized to monitor, collect, and analyze data about our environment to determine if we are meeting our carbon neutrality goals and making informed environmental and business decisions.

Objective: An Equitable and Inclusive Community

Smart city solutions must support the city's One Community Initiative and ongoing Diversity, Equity, and Inclusion (DEI) initiatives. It is crucial that all future projects and opportunities the city deploy have a data collection mechanism imbedded to help ensure DEI objectives are being met.

The IT department is currently working with Human Resources, Systems Planning, and Sustainability to develop an organizational analytics tool using the city's Business Intelligence Platform, GIS, and stored city data to aide in determining if we are providing city services in an equitable, inclusive and sustainable manner. The IT department will continue to utilize our project delivery methodology to identify equity and inclusion as part of new city projects and opportunities.

Goal 3: Build and Maintain a Modern, Innovative, and Sustainable Smart City Ecosystem

The primary foundational building blocks to a successful Smart City Ecosystem is a robust telecommunication infrastructure, Business Intelligence or "Big Data" Platform, cyber security, strong partnerships, and a consistent project delivery methodology to ensue business requirements and needs align with the city's strategic plan(s).

Any organization, public or private, need assurances their telecommunications infrastructure is reliable, dependable, and sustainable. The city continues to expand its telecommunications infrastructure utilizing standards and best practices to maintain quality and implement additional capacity to serve the community well into the future.

Our communications infrastructure must remove traditional barriers and promote seamless access to facilitate for collaboration and communications for all community stakeholders..

The city has adopted the following strategies, standards, best practices, and specifications to ensure consistency, quality and sustainability in order to attract community organizations to utilize our telecommunications infrastructure.

## Objective: Disciplined Telecommunications Strategies, Standards, and Best Practices

The city and the Information Technology department employ many strategies and a delivery methodology in order to maintain the integrity of the city's information systems and meet the goals of the city. Following are some of the essential best practices and initiatives implemented, or being implemented as part of this plan, in order to maintain a healthy and sustainable ecosystem:

A Digitally Connected Community

The city's conduit and fiber infrastructure are built to accommodate not only the city, but the community as a whole. As the city designs and plans our infrastructure, we engage key city and community stakeholders on a project-by-project basis and solicit feedback and input to ensure we are capturing needed requirements.

Our goal is to continue to build a fiber backbone so dark fiber is easily assessible and affordable to public and private organizations, which in turn will promote the use of the fiber and give the community more choices as it relates to high-speed broadband access. A connected community can greatly enhance collaboration, partnerships, and communications which can lead to efficiencies and cost savings.

A Technology Park or Innovation District is currently being designed in the DDA District. It consists of a dense conduit and fiber telecommunications infrastructure

backbone with the capability to connect each building in the district with high-speed fiber. This will reduce the capital cost to connect each building to the backbone, remediate older city conduit and fiber, promote economic development,
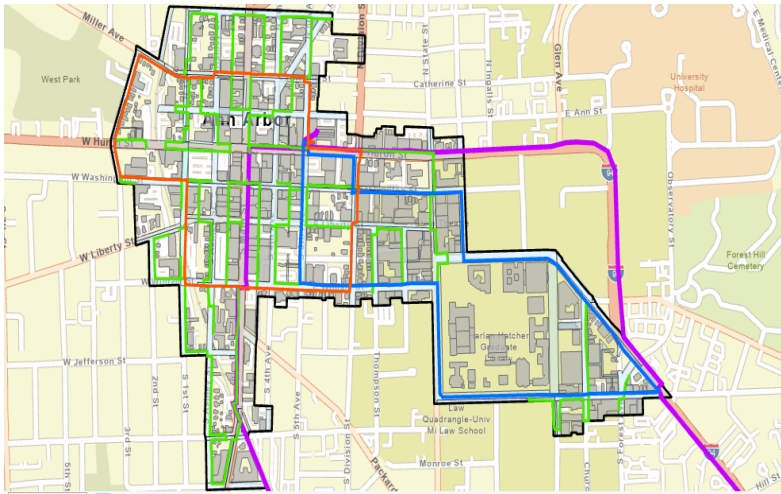
provide the foundation for existing and future smart city use cases, and promote research, development and testing for smart city opportunities.

Conduit and fiber are being planned to extend beyond the city border to connect the City of Ann Arbor and City of Ypsilanti Smart Zones and expand a transportation corridor to be utilized for the continued research and development of connected/autonomous transportation and mobility. We will also continue to expand the city's private and public wireless networks as needed.

Fiber Optic and Smart Sensor Infrastructure Design Strategies and Standards

As we expand our telecommunication infrastructure additional conduit and fiber capacity is built in to each segment to ensure future growth and expansion and mitigate the need for concrete removal and remediation or a "Dig Once" approach. The physical layout, or route, of our telecommunications infrastructure is engineered for resiliency, failover, and redundancy. This will accommodate organizations that have a need for critical services and applications. If possible, all fiber will be placed underground, as opposed to aerial, for reliability reasons, and fiber will be terminated in a central location(s) to facilitate flexible reconfiguration, as we strive to utilize wired solutions first.

The IT Department meets with the city's Engineering department, including the Signs and Signal and Transportation teams, and the DDA annually to review Capital Infrastructure Projects (CIP) to determine if conduit and fiber is needed in the early stages of the project and to adhere to our "Dig Once" approach. We will continue to take a proactive and collaborative approach, internally to the city and community-wide, towards expansion and (or) remediation of our telecommunications infrastructure and smart city deployments.

Multi-purpose smart sensor devices *will be deployed, where feasible, to limit the number of devices and structures needed in the field for efficiency and aesthetic purposes. These multi-use devices can be equipped to accommodate many smart city solutions utilizing one smart device.*

Telecommunications Ownership, Maintenance, and Use

The city exclusively owns and maintains the city conduit and fiber infrastructure backbone. We feel this is critical to ensure consistency, integrity, access, sustainability, and availability of our telecommunications infrastructure. The city and (or) its contractor(s) are solely responsible for any adds, moves, and changes to the infrastructure.

The city will continue to solicit the use, and (or) lease, of our conduit and dark fiber assets to public and private organizations. The city incorporates the above standards into all use/lease agreements in place with the organizations using or wanting to use/lease conduit or dark fiber. The city is not, and has no plans to become an Internet Service Provider (ISP) and cannot "light" fiber for anyone except the city. Revenues generated from the utilization of the city's dark fiber will be utilized to maintain a quality and sustainable telecommunications infrastructure.

Cyber Security and Data Privacy

Cyber security is pervasive to all aspects of information technology and mitigating cyber security threats to our network continue to be one of the most challenging tasks for the IT department. There is a potential for thousands of smart IoT sensors/devices that could be deployed throughout the city, thus increasing the risk of being compromised. It is critical data remain safe, secure, and private. All opportunities to connect smart sensors on the city's network will be evaluated for security and other systems will be leveraged to harden our cyber security posture to mitigate threats.

Objective: Promote and Support Enterprise Data-Driven Decision Making (A2 Analytics)

_____

Data/Information or knowledge, if utilized properly, can be very powerful and lead us to operational excellence. Large quantities of data will be generated from smart city sensors/devices, systems, and applications. The IT department implemented a Business Intelligence (BI) platform (aka "Big Data")

to accommodate this influx of data as well as organize, analyze, cleanse, and report the data back to city business units and (or) the public in the form of metrics, dashboards, infographics, and Key Performance Indicators (KPI's). The goal is to utilize this valuable information to provide city management and departments data about the performance of their systems and to facilitate informed decision making.

Goal 4 of the 2021-2022 IT Department Technology Plan is to "Promote and Support Enterprise Data-Driven Decision Making." Our approach is to utilize the IT department Project Delivery Methodology and data sciences to capture, analyze, visualize, and deliver our data to the organization and community. All relevant data will be placed in a central repository for use throughout the organization while eliminating redundancy. As business problems or opportunities arise we will take a holistic view of our data, ensure privacy and transparency, and determine the source(s) of our data is trusted.

Our new BI platform was selected because of its ability to be end user-friendly and self-service so the organization can utilize tools to analyze their data with minimal assistance from the IT department. As visualization tools are delivered to our business units they will be trained to be self-sufficient.

Metrics to support the city's strategic plan have been defined, will continue to evolve, and will prominently be displayed both internally and externally. The goal is to capture and analyze data to inform our citizens and provide outcome-based metrics on how the city is performing.
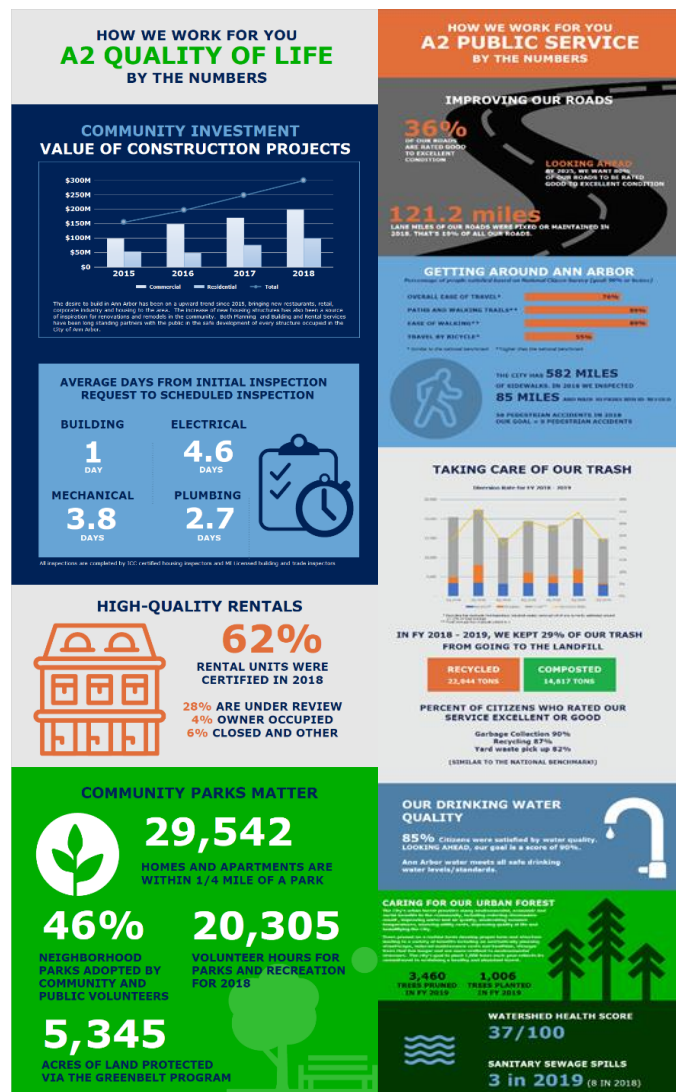
Historically, organizational data has existed in silos and required specialized resources to extract and make sense of the data. The City of Ann Arbor has 46 departments and 140 applications, with many departments having unique software needs. The needs for each department vary, thus making city operations very complex to support. The IT department has a history of developing integrations between software applications to improve efficiencies and automate tasks, and this will continue. As the city continues to pursue new projects or opportunities departments need to work together to integrate activities and tasks, and share data across departments.

The IT department project Delivery Methodology will continue to be promoted and implemented throughout the city to ensure we are considering equity, sustainability, and smart city concepts for all new opportunities and to ensure we are capturing clear and concise business needs that align with the goals of the city and continue to fine-tune our operations, eliminate waste, and improve our service delivery excellence.

Objective: Build Strong Community Relationships

Effective communications are key to a successful strategy. This strategy is not only being developed for the city but the community as a whole. Communication can always be improved, and traditional silos need to be broken down. A strong communication plan and *a city/community Smart City advisory team will be established* to ensure we are sharing information, exploring new opportunities, enhancing relationships, effectively communicating to all key city/community stakeholders, and taking full advantage of our smart city ecosystem.

Qualified workers in areas such as mobility, autonomous and connected vehicles, transportation, data sciences, Machine Learning and Artificial Intelligence are needed to meet workforce demands. The city will work with community educational institutions and offer assistance in developing curriculum and training needed for our next generation work force. A goal is to utilize our smart city ecosystem to attract businesses and talent to the area, and retain the talent, so we have a sufficient pipeline of qualified resources.

Goals, Objectives, and Initiatives Summary

Goal 1: The Most Desirable City to Live, Work, and Play

Objectives:	Initiatives:
Enhance City Services	✓ Implement internal methodology to ensure smart city solutions are being considered for new implementations and upgrades to existing city infrastructure assets or systems. ✓ Connect city assets so data can be captured to assist the city in making more informed business decisions. ✓ Collaborate with the DDA to implement smart solutions in the DDA District. ✓ Examine the feasibility of Asset Tagging for Parks. ✓ Implement river water flow sensors for the Water Treatment Plant. ✓ Expand Smart Lighting. ✓ Implement snow and rainfall sensors for Public Services. ✓ Collaborate with the DDA on future smart parking and curb management technology.
Smart Transportation and Mobility	✓ Continue collaboration with UMTRI vehicle to everything (V2X) connected infrastructure. ✓ Pursue opportunities to enhance the safe and efficient movement of people. ✓ Implement signal priority and/or preemption for efficient transit and emergency response. ✓ Continue to expand smart and connected signs and signals such as adaptive signal control. ✓ Develop a local intelligent transportation system architecture.
Promote Technology Park/Innovation District	✓ Complete the Technology Park/Innovation District construction of fiber and conduit in the DDA District. ✓ Connect the remaining DDA parking structures and lots in the DDA District to the city fiber. ✓ Continue to densify the city communications infrastructure.

	✓ Collaborate with SPARK, DDA, and other community stakeholders to promote the value and use of the city's communications network to attract and retain people and businesses to Ann Arbor. ✓ Pursue an EDA grant to connect the Ann Arbor and Ypsilanti Smart Zones.
Promote Smart Affordable Housing	✓ Provide high-speed communications to all Housing Commission structures to accommodate employees and (or) tenants. ✓ Implement connected and integrated building automation systems. ✓ Provide smart technology to allow for Aging in Place.
Bridge the Digital Divide	✓ Enhance affordability, equitable access, and choices to high-speed communications for all. ✓ Promote the use of the city communications network to local educational institutions and other government agencies.

Goal 2: Improve the Quality of Life

Objectives:	Initiatives:
A Safe Community	✓ Pursue smart solutions to assist in keeping our community safe such as smart lighting, signal preemption, video surveillance, gun-shot detection, 2-way citizen communications, etc. ✓ Enhanced collaboration and end-to-end communications among all community first responders to reduce response times and increase knowledge sharing.
A Healthy and Environmentally Friendly Community	✓ Strategically place environmental sensors throughout the city to capture and make available environmental data. ✓ Strategically place informational kiosks around the city. ✓ Connect EV changers. ✓ Implement and connect buildings energy management systems to the city fiber.
An Equitable and Inclusive Community	✓ Develop a mechanism to ensure Diversity, Equity, and Inclusion is being considered for all capital projects and city processes. ✓ Develop a DEI analytics tool. ✓ Implement an internal methodology to ensure DEI is being considered for all opportunities/project. ✓ Develop and implement a city privacy policy as it relates to data collection in outdoor public spaces.

Goal 3: Build and Maintain a Modern, Innovative, and Sustainable Smart City Ecosystem

Objectives:	Initiatives:
Disciplined Telecommunications Strategies, Standards, and Best Practices	✓ Develop a community "Dig Once" strategy. ✓ Strategically expand the city communications infrastructure. ✓ Conduct regular CIP meetings to anticipate and plan for future fiber, conduit, and smart city solutions. ✓ Continue to enhance a city Fiber and Conduit Use model. ✓ Establish a Program Management Office and Project Delivery Methodology to ensure consistency, equity, sustainability, integrity, privacy, and security for all new opportunities/projects. ✓ Pursue public/private relationships.
Promote Data Driven Decision Making	✓ Maintain a strong Business Intelligence platform. ✓ Build the use of metrics into city processes, operations, and the city culture. ✓ Promote the use of technology to monitor and operate city assets and to capture data for city assets, where feasible. ✓ Share data with transparency. ✓ Continue to integrate and consolidate enterprise data. ✓ Provide data for utilization in decision making.
Build Strong Community Relationships	✓ Establish regular community stakeholder meetings and a communications plan to ensure collaboration and encourage the utilization of the smart city ecosystem. ✓ Continue to expand collaboration with community stakeholders ✓ Work with Educational Institutions to promote smart city education and use of the smart city ecosystem.