SMART Woodstock

October 2020

CITY OF WOODSTOCK
GEORGIA

POND

MODERN MOBILITY partners

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Introduction

Woodstock is a rapidly growing town about thirty miles northwest of Atlanta. A historic railroad town, suburban growth in the area has recently provided a force for new development and opportunities in the area. Woodstock has worked to meld this new growth and pressure with its history and modern planning and has created a successful, vibrant downtown anchored by a large amphitheater that hosts free concerts and events and filled with eateries and boutique shops. The facing page includes a map of the Downtown Woodstock area, with major features and attractions identified.

These successes have arrived with their own challenges. Parking is a commonly cited concern as is pedestrian safety on streets that are narrow and in some areas on the fringe lack dedicated pedestrian accommodations. The rail line that gave Woodstock its start can be an obstacle to vehicular mobility and to movement of all modes between the east and west sides of Downtown Woodstock. Pass-through commuters use Main Street to cross town, adding to vehicular congestion.

Smart Woodstock Downtown Study Area

Georgia Smart Communities Challenge

The Georgia Smart Communities Challenge is a technical and financial assistance program sponsored by a wide array of public and private organizations, run by the Georgia Institute of Technology (Georgia Tech), and funded by the Atlanta Regional Commission (ARC). The program provides Georgia communities of any size with assistance and resources to envision, plan, and implement a smart and connected future. Assistance includes up to $100,000 in grant funding, a partnership with a Georgia Tech research team, and potential access to additional unique resources through the various partnering groups.

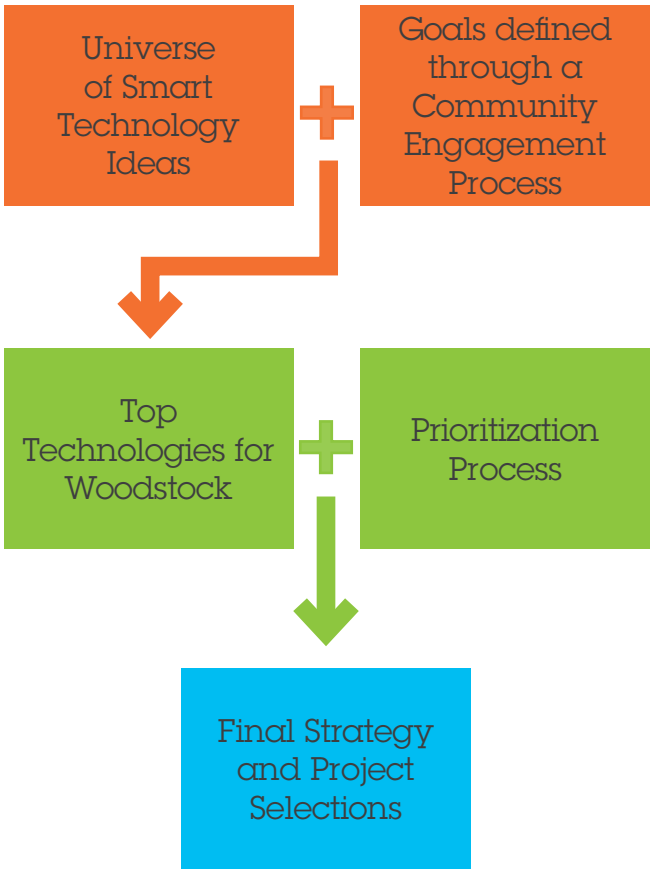
The City of Woodstock applied for and was awarded a slot in the Georgia Smart Communities Challenge 2019. The City of Woodstock collaborated with the Woodstock Downtown Development Authority, Black Airplane (a local Woodstock tech startup), and Siva Ramachandra (a researcher at Georgia Tech). In Woodstock's application to the program, the City included the following end-goals and outcomes:

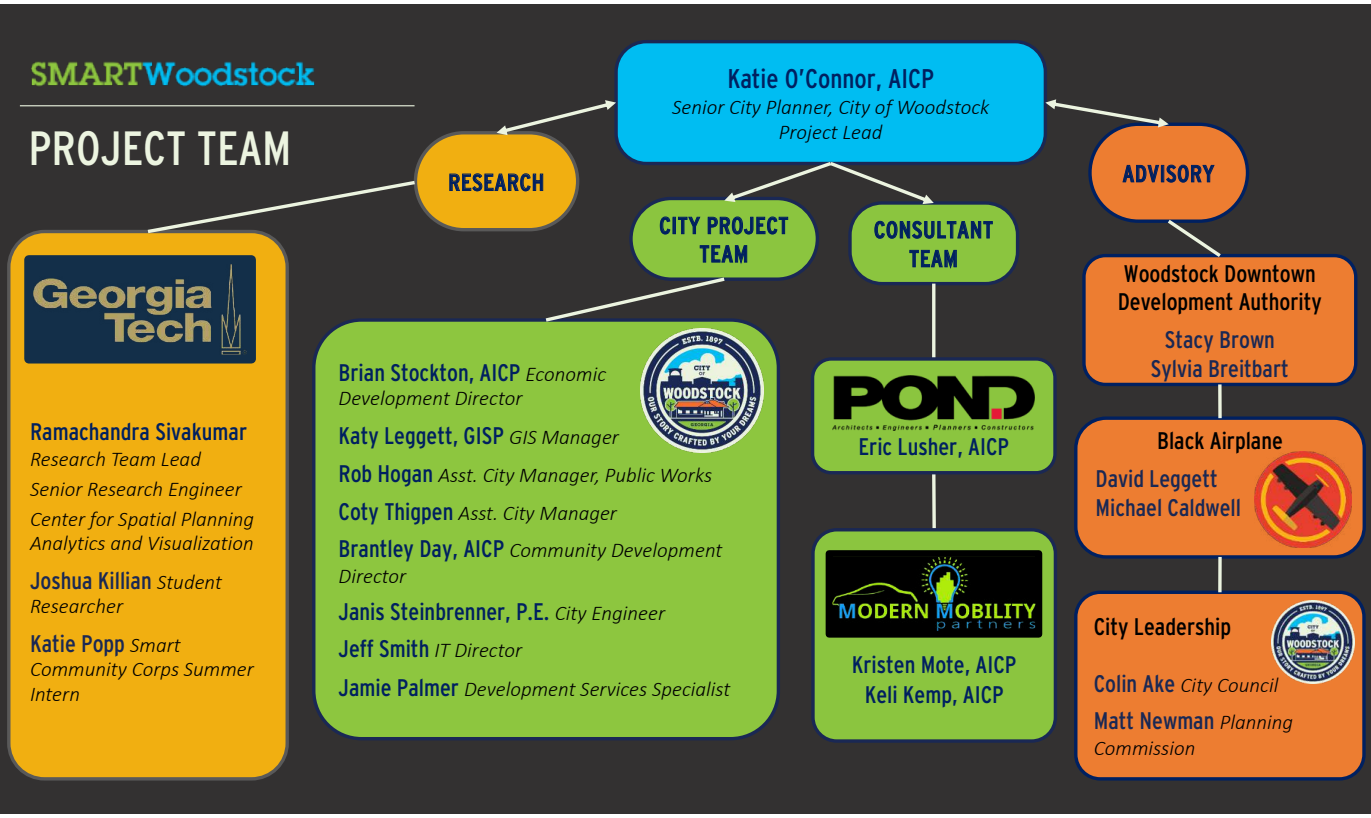
1. Leadership in municipal efficiency and smart governance, with a focus in the area of transportation systems and pedestrian safety using smart technology
2. Quality of life outcomes for citizens identified, fulfilled, measured, and continuously evaluated, with a commitment to consistent improvement
3. Readiness for taking advantage of new technological and scientific advances, including the ability to perform rapid-fire testing of new ideas with pre-identified funding sources and collaborative partnerships allowing the agility to adopt new technologies more like a startup than a government
4. Development of best practices to share with other local governments
5. Investment in sustainable infrastructure technology that can balance walkability and transportation efficiency, in turn helping to drive economic development and maintain downtown vibrancy
6. Investment in data capture which can shed light on our most troubling issues now and in the future, and will make research possible that cannot yet be imagined

The City also chose to focus their application on Smart Mobility, with an emphasis on the Downtown Woodstock area. The City wants to be on the cutting edge of emerging technologies regarding mobility of varying travel modes. To achieve this and to create an implementation-ready project, the City has forked this effort into two focus areas: A Smart Woodstock Master Plan that includes policies and regional strategies and covers the entirety of the City (called the Citywide Strategy in this report), and a Downtown focus that provides specific projects and considerations for the immediate Downtown area, focusing on the main crossroads of Main Street and Towne Lake Parkway (called the Downtown Strategy in this report). The full application to the program is included in **Appendix A**.

Overview of Planning Process

The City and its various partners set out to develop a citywide strategy to define how to become a smart city as well as a corridor study to identify specific locations and technologies to solve pressing issues. The City's Research and Consultant teams helped define the universe of smart technology options that Woodstock could consider. Community engagement helped to identify what outcomes were desired by the public. This information was used to refine the technologies in consideration to a set of top technologies for Woodstock specifically. This document also includes a prioritization of those top technologies based on input received to provide more nuanced guidance to the city and its partners when implementing future projects.





Visioning & Community Engagement

Development of Guiding Principles

To lay the groundwork for later community engagement and to identify goals for the overall project, the planning team had a brainstorming session to identify possible outcomes and goals of a smart technology project in Woodstock. Through multiple iterations and contributions from all branches of the planning team, the following ten guiding principles were created:

- Environmental Benefits
- Improve transparency in government
- Technology that won't become obsolete quickly
- Improve vehicle, pedestrian, and bicycle safety
- Opportunity to create economic development
- Cost savings and fiscal responsibility
- Potential return on investment
- Improve transportation travel times
- Infrastructure monitoring
- Crime prevention and monitoring

Community Engagement

In order to get input on this initiative from a broad sample of the public, the community was engaged through a variety of in-person and online activities.

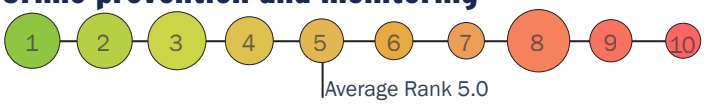
Guiding Principles Activity

In December 2019 and January 2020, representatives of the Smart Woodstock effort went out to meet people in Downtown Woodstock and interviewed those people about what they'd like to see from a Smart Technology project in the area. As part of these conversations, participants were asked to rank the ten guiding principles from most important to least important. The input received was combined with an identical online activity and used to create the graphic on the facing page. More complete information on intercept responses is included in **Appendix B**.

#1 (tie) Improve vehicle, pedestrian, and bicycle safety

#1 (tie) Improve transportation travel times

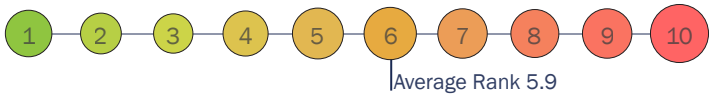
#3 (tie) Crime prevention and monitoring



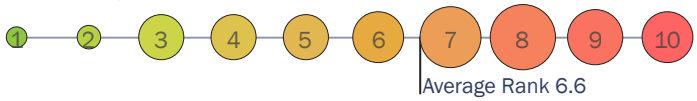
#3 (tie) Opportunity to create economic development

#5 Cost savings and fiscal responsibility

#6 Potential return on investment

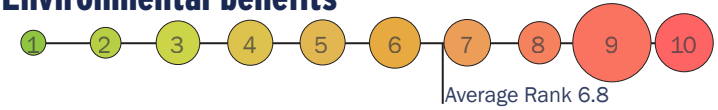


#7 Technology that won't become obsolete quickly

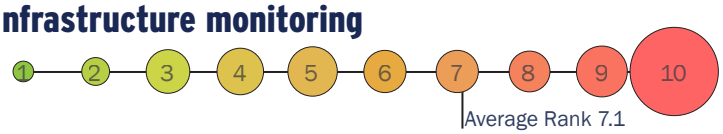


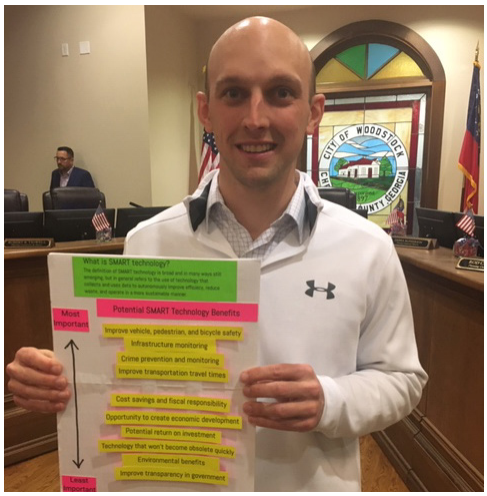
#8 Improve transparency in government

#9 Environmental benefits

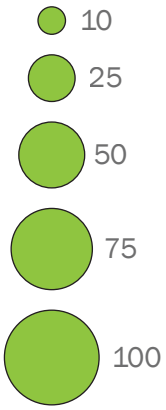


#10 Infrastructure monitoring





Number of Responses

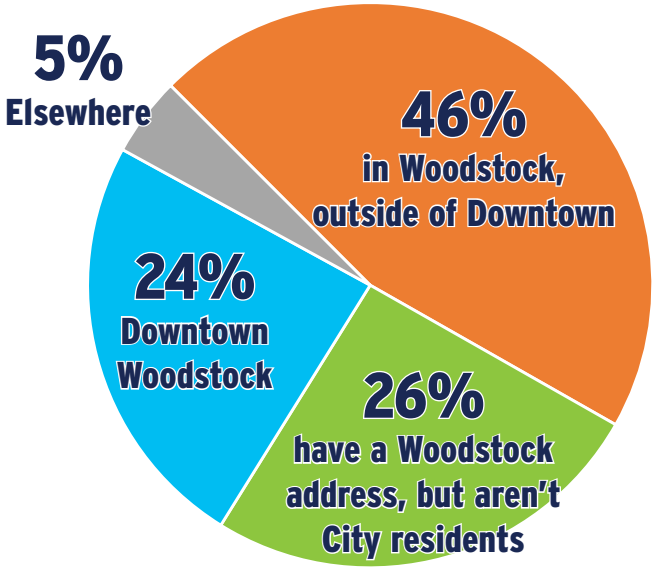


Total Responses: 469

Downtown Survey

The online Downtown Survey was included to learn more about how residents and visitors experience Woodstock. Questions included travel modes when visiting Woodstock, experiences with parking and travel through the downtown area, and another ranking activity. This ranking activity asked participants to rank investments in categories such as walkability, bikeability, driving times, and parking options both within and on approach to downtown. A sampling of results from the survey are shown below and full survey output is included in **Appendix D**.

Where Survey Respondents Live

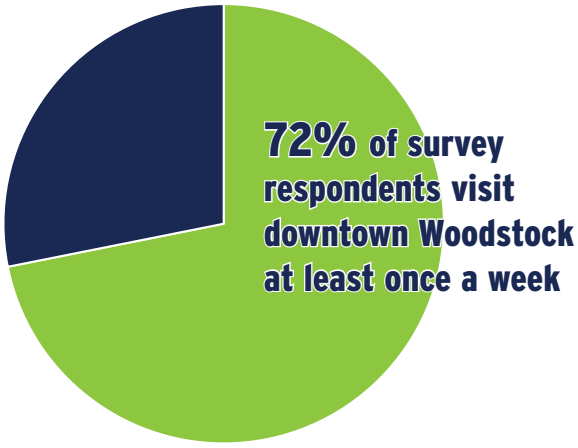


95% of survey respondents listed a car as their primary mode of transportation

When visiting Downtown Woodstock, **83%** of survey respondents drive

Most Important Potential Investments for Downtown Woodstock

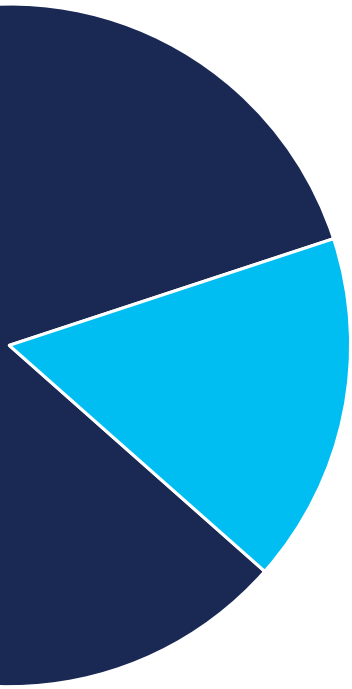
1. Improved walkability to downtown
2. Easier parking options
3. Improved walkability in downtown



When asked "How often do you find an available parking space in Downtown Woodstock at your preferred location"...

39% said more than half the time or nearly every time	24% said about half of the time	38% said less half the time or almost never

83% of survey respondents who say they drive through Downtown Woodstock avoid Main Street either all the time or at certain times of the day due to congestion



Top Words Used When Asked "What is your favorite thing about Woodstock?"

Interactive Map Activity

The online activities also included a map-based activity. Participants were able to add "pins" to a map of the downtown Woodstock area to provide feedback. Pins were provided in a series of categories, including:

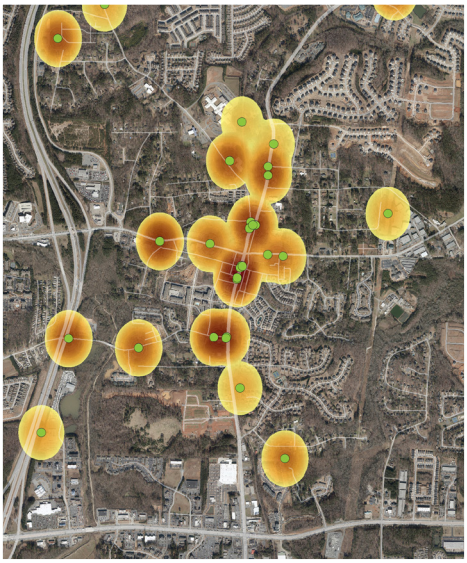
- Places and Businesses I Visit
- Traffic Congestion
- Bicycle or Pedestrian Issue
- Where I Try to Park My Car
- Other Ideas and Comments

Participants could leave text on their pin to explain their motivation and/or provide additional information to the planning team. Participants could also review pins placed previously and "Like" or "Dislike" their pins, providing deeper understanding about the consensus opinions within the community. 759 pins were placed and 836 Likes and Dislikes were provided on those pins. Selected aspects of this activity are presented below and on the facing page, and full activity output is included in **Appendix E**.

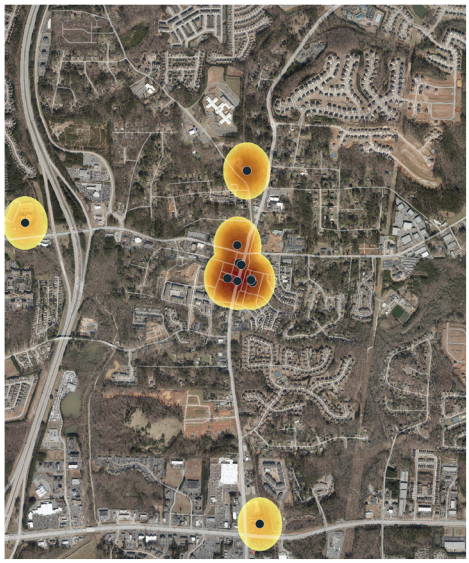
Many of the responses received in this activity and the other community engagement activities were focused on transportation needs and constraints in the downtown area. Highlights include traffic congestion, especially along Main Street; limits on parking availability in the Downtown core; and pedestrian concerns for those walking around the Downtown area.

Interactive Map Activity - Pin Like Concentration by Category

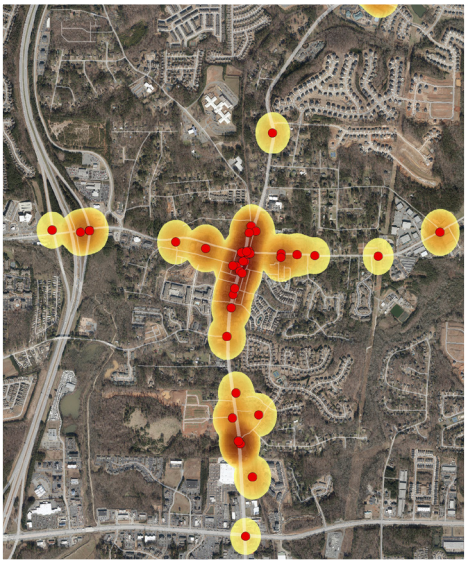
Bicycle or Pedestrian Issue



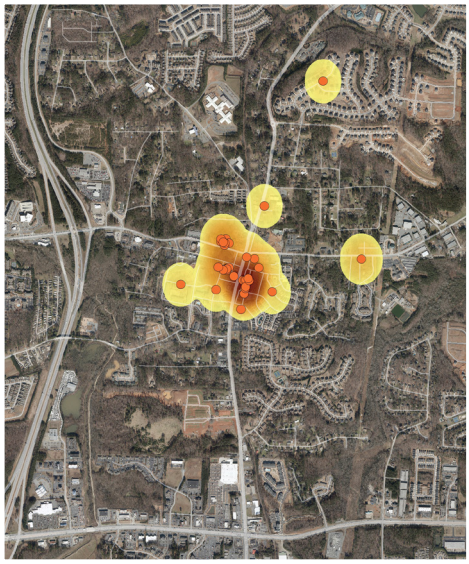
Places and Businesses I Visit



Traffic Congestion



Where I Try to Park My Car



Interactive Map Activity - Pin Concentration and Selected Pins

Virtual Site Visit

As part of the Georgia Smart program, each participating community typically host a site visit with representatives of the other participating communities and the program partners. Due to the COVID-19 pandemic, the site visit for Woodstock was held virtually on June 24, 2020. The program included sessions in which the team welcomed all participants to Woodstock and an overview of the planning process. In lieu of a traditional site visit, the planning team put together narrated videos taking various pedestrian routes through downtown and used it to explain some of the challenges and opportunities present in the area. The program wrapped up with a panel discussion about Woodstock and the smart projects under consideration at that time.

Virtual Site Visit Video Stills

Smart City Technology Universe

The City of Woodstock is a leader in the metro Atlanta region in thinking and preparing for the future of transportation and smart city technologies. The technology environment is rapidly changing, and the City is taking the necessary steps to adequately plan for and implement technologies to support the goals of the City, its citizens, and the business community. This chapter outlines the process of developing, evaluating, and ranking a list of technology strategies and makes recommendations for applicable technologies both at a citywide scale but also strategies specific to improving the Downtown Woodstock Corridor.

Establishing a Universe of Smart City Technologies

Based on the results of the Smart Woodstock Citywide Strategy Survey, a universe of technology strategies was identified based on the desires of the citizens. Research on established and emerging technologies was completed, including technologies being developed from across the globe. The strategies were then narrowed to a list that focuses on the results from the survey.

Below is a preliminary list of technologies available for the City of Woodstock to evaluate, indicating which goals each technology strategy addresses.

Universe of Smart City Technology Strategies

Project Type	Goals									
	Safety	Crime Prevention	Travel Times	Economic Development	Cost Savings	Return on Investment	Low Need for Future Updates	Government Transparency	Environmental Benefits	Infrastructure Monitoring
Signal priority (transit, bicycle, pedestrian)	✓		✓	✓	✓		✓		✓	
Signal pre-emption (emergency vehicles)	✓	✓	✓	✓		✓	✓	✓		
Signal countdown digital signage	✓		✓				✓			
Adaptive traffic control	✓		✓	✓			✓			✓
Vehicle-to-Infrastructure, vehicle-to-vehicle, vehicle-to-everything applications	✓	✓	✓	✓			✓			✓

Universe of Smart City Technology Strategies (continued)

Project Type	Goals									
	Safety	Crime Prevention	Travel Times	Economic Development	Cost Savings	Return on Investment	Low Need for Future Updates	Government Transparency	Environmental Benefits	Infrastructure Monitoring
Integrated data exchange	✓	✓	✓	✓			✓	✓		✓
Cross alert system for bicycle/ pedestrian (motion sensor triggers)	✓		✓				✓			✓
Flashing pedestrian beacons	✓		✓				✓			✓
School zone beacons	✓		✓				✓			✓
Solar/smart streetlights	✓	✓			✓	✓	✓	✓	✓	✓
Solar/smart pavement/ sidewalks (Wi-Fi, striping, electric vehicles)	✓	✓					✓		✓	✓
Bicycle traffic signals	✓		✓				✓		✓	
Digital wayfinding signs/kiosks	✓		✓	✓			✓			
Navigation assistance sensors for visually impaired	✓		✓	✓			✓			
Autonomous shuttles			✓	✓			✓		✓	✓
Mobility as a Service (Plan, ticket, and pay for all modes in one application)			✓	✓	✓		✓		✓	
Real-time transit data and system coordination			✓	✓			✓		✓	
Vehicle/Pedestrian warning applications (in transit vehicle)	✓		✓	✓			✓			✓
Bus stop warning applications (alerts nearby vehicles or pedestrians)	✓	✓	✓				✓			✓
Automated Parking Systems (garage or outdoor system)	✓		✓	✓	✓	✓			✓	✓
Parking availability application (included preferred parking for carshare)			✓	✓	✓	✓	✓		✓	✓
Smart parking meters and parking management systems			✓			✓	✓			✓

Universe of Smart City Technology Strategies (continued)

Project Type	Goals									
	Safety	Crime Prevention	Travel Times	Economic Development	Cost Savings	Return on Investment	Low Need for Future Updates	Government Transparency	Environmental Benefits	Infrastructure Monitoring
Electric Vehicle (EV) charging stations			✓	✓		✓	✓		✓	✓
EV charging outlets in smart light polls			✓							
Automated traffic monitoring/ detection	✓	✓	✓	✓		✓	✓	✓		✓
Roadside sensors to communicate conditions	✓		✓		✓		✓		✓	✓
Smart dots in street centerlines	✓		✓		✓		✓	✓	✓	✓
Cameras/license plate readers	✓	✓	✓	✓			✓	✓		✓
Gunshot detection technology	✓	✓		✓			✓	✓		
Public Wi-Fi			✓	✓			✓			
Curb/lane flexibility	✓		✓	✓					✓	✓
Technology for extreme weather conditions	✓		✓				✓		✓	✓
Construction zone related applications	✓		✓	✓						
Flexible curbside management (loading, Lyft/Uber, on-street parking, EV charging)	✓	✓	✓	✓			✓			
Shared Mobility	✓	✓	✓	✓	✓		✓		✓	
Micro-mobility			✓	✓	✓		✓		✓	
Micro-delivery (drone, autonomous couriers)		✓	✓	✓	✓		✓		✓	
Trash receptacle sensors	✓	✓		✓	✓		✓	✓	✓	✓
Video Surveillance	✓	✓		✓			✓	✓		

Identifying Technologies for Evaluation

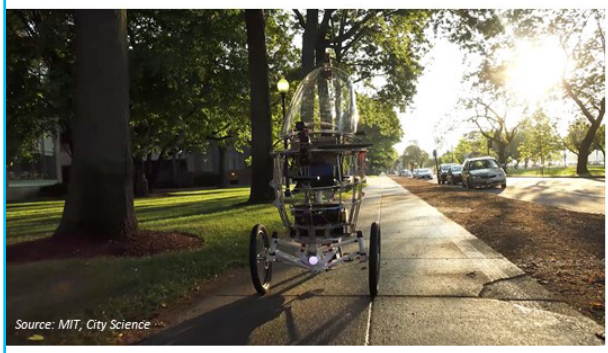
The strategy list was compared with the vision, goals, and objectives of the City Council as well as existing ordinances to develop a short list of technology strategies that are deemed to be in compliance with ordinances and advance the goals of the City, the citizens, and this Plan.

The technologies are presented below and are categorized into five areas – mobility, parking, data/information sharing, connected and autonomous vehicles, and goods/delivery. Mobility refers to any technology strategy that helps the efficiency of movement for residents, employees and visitors and can cover any mode, bicycles, pedestrians, auto, etc. Parking strategies are those that assist with identifying parking locations and in some cases monetary transaction for parking meters. Data/Information Sharing refers to strategies that process data, compare with other databases, and provide notifications. For example, roadside sensors obtain data from the roadway, process it through a database center and can also broadcast information out to infrastructure or connected vehicles. Connected and Autonomous Vehicles are any strategy that communicates with or assists connected and autonomous vehicles. Finally, Goods/Delivery technologies are those that specifically assist with the movement of goods or the loading/unloading of goods such as flexible curbs and loading zones. Most technology strategies will cover more than one of these categories.

Please note that costs presented below are in year 2020 dollars. All of these costs are intended to be advisory and used for comparison between strategies. Specific costs for implementation in the City of Woodstock will vary depending on specific project requirements. These cost estimates are based on previous implementations, vendor costs, or other research. All projects in Woodstock will need to be individually approved by City Council before implementation. Sources for costing of each strategy are included in **Appendix F**.

Citywide Strategies

The strategies were categorized by Citywide or Downtown Corridor. The following images are Citywide Strategies, or strategies that would benefit the City as whole.



Autonomous Micro-Mobility

Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

Micro-mobility is last mile modes such as small personal vehicles. The future of these services are anticipated to be autonomous where a person orders a micro-mobility trip from a mobile device and the vehicle navigates autonomously to the pick-up location. It is important that this technology have the capability of self storage to not clutter sidewalks or other public spaces.

Estimated Cost: Example is a prototype, and these are not on the market yet. Estimated to be similar in cost to electric bikes ($400-$2,000)

Image Source: CityLab

Image Source: West Michigan Strategic Alliance

EV Charging Stations

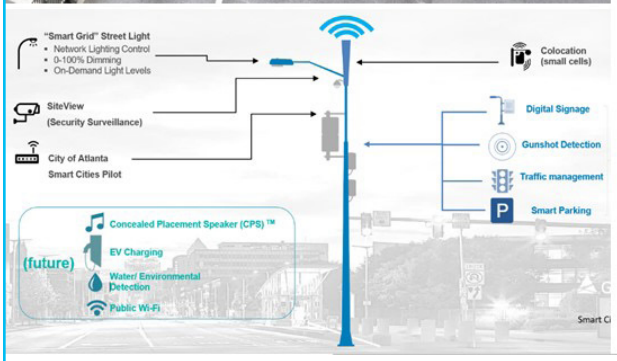
Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

Electric vehicle (EV) charging stations are infrastructures that can charge the battery of electric vehicles. At present there are three levels of EV charging stations: Level 1 (2 to 5 miles of range per hours of charging), Level 2 (10 to 60 miles of range per hour of charging), and Level 3 (180 to 300 miles of range per hour of charging). This strategy would have the City expand their existing system with additional charging stations.

Estimated Cost:

- Level 2 charging stations, cost vary from $500 to $700, with parts and labor costing $1,200 to $2,000.
- Level 3 charging stations, cost vary from $1,000 to $2,000, with parts and labor coting $2,300 to $6,000.



Roadside Sensors

Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

Roadside sensors use radar and/or lidar sensor technology to communicate information to connected and autonomous vehicles such as navigation information and roadway alerts (such as road closures). These sensors can be retrofitted to existing infrastructure such as traffic signals or streetlights and will ultimately use 5G broadband for its communication.

Estimated Cost: Lidar sensors can range from $500-$1,000 per unit

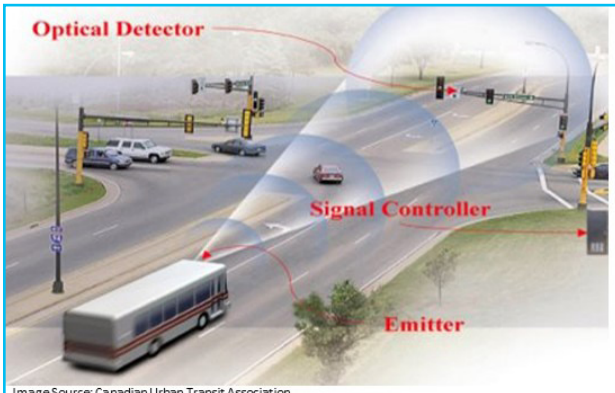


Image Source: Canadian Urban Transit Association


Image Source: Vancouver Public Space

Signal Priority (Transit, Bike, and Pedestrian

Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

Traffic signal priority is an operational strategy to reduce the delay to transit vehicles, bicyclists, and pedestrians at signalized intersections. This requires communication between vehicles and sensors to alter the signal timing to favor transit, bicyclists, and pedestrians.

Estimated Cost: $13,500 per intersection for detection and equipment. Vehicle cost ranges from $75 to $500 per unit.

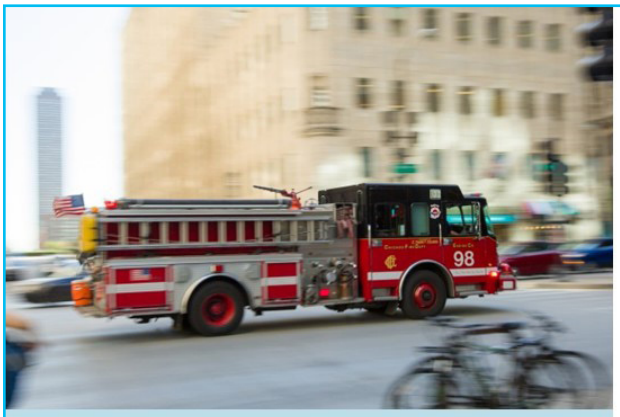
Adaptive Signal Traffic Control

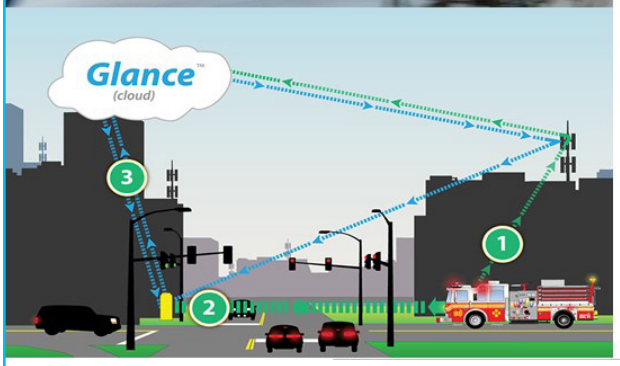
Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

Connected vehicle-based ASTC systems can provide real-time spatial information (such as, position, speed, and acceleration and other traffic data) necessary for evaluating traffic conditions on a road network. Communications between a vehicle and infrastructure enables the intersection controller to obtain much more detailed information of the surrounding vehicle states within the transmission range.

Estimated Cost: $25,000 per signalized intersection





Signal Pre-emption

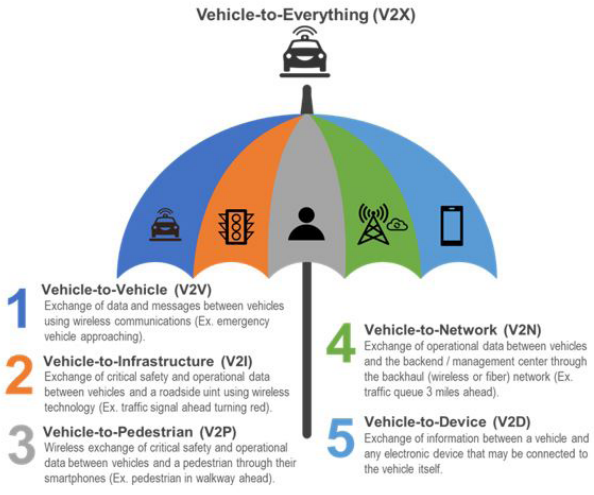
Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

Traffic signal pre-emption is a system that allows the normal operation of traffic signals to be deterred. Typical operations is intended for emergency responders to approach green lights with out traffic back up and reduce response time.

Estimated Cost: $5,000 per intersection for equipment. Vehicle cost is approximately $2,500 per unit. This includes five years of cellular service.

Vehicle to Everything



**Note: Railroad event broadcasting would fall under V2X*

Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

V2X systems can convey important information to a driver in regards to dangerous activities of nearby vehicles (V2V, vehicle-to-vehicle), presence of pedestrians and cyclists crossing the road (V2P, vehicle-to-pedestrian), traffic signal ahead is about to change to red (V2I, vehicle-to-infrastructure), and inclement weather, nearby accidents and road conditions ahead (V2N, vehicle-to-network).

Estimated Cost: The cost to install necessary equipment at the intersection is about $10,000 per intersection for V2I. Source: GDOT CV1K Initiative

Downtown Strategies

The following are Downtown Corridor strategies, or those that are most appropriate for the downtown Woodstock area

Smart Parking Meters

Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

Smart parking meters are automated parking systems which allow for a self-parking, paperless system aimed at making parking easier for cities and drivers. They work in conjunction with parking apps, street sensors and/or mounted cameras.

Estimated Cost: Smart parking meters typically cost between $250 - $500 per meter per space.

** Note: Smart Parking Meters will only move forward with Council's direction*

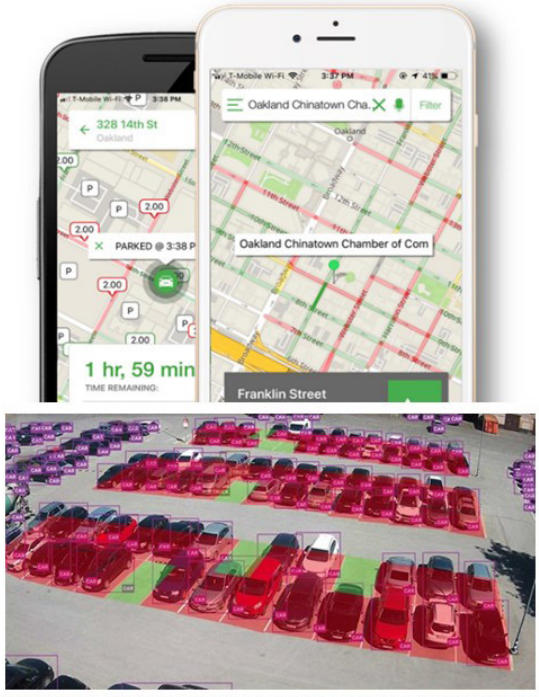


Image Source: https://www.parking-net.com/parking-news/pixevia/artificial-intelligence-smart-parking

Parking Availability

Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

Real-time parking availability apps serve to inform drivers of available parking spaces based on sensors or cameras that detect when a space becomes available. This may also be broadcasted using dynamic signage at the entrance to a parking lot or parking deck to show how many spaces are available. May also be integrated into existing app platforms.

Estimated Cost: Ultrasonic sensors are approximately $300-$500 per unit. Camera-based systems may have a nominal cost if security cameras are already in place. Other detection tools (infrared, inductive loops, etc.) have varying costs.

Image Source: Visionect & GDE E Ink

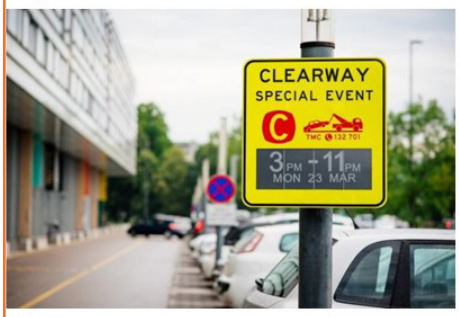


Image Source: https://www.thecarconnection.com/news/1099485_australia-takes-a-cue-from-amazon-rolls-out-e-ink-parking-signs

Electronic Ink Signs

Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

Electronic Ink Signs operate with minimal energy consumption and minimal installation costs. The technology is updated via mobile connection and is often self-powered by solar energy. The technology can provide real time information for various transportation purposes such as transit schedules, parking information, and wayfinding. Panels can be combined to provide larger displays and can be seen in direct sunlight with a picture quality equal or better to 4k.

Estimated Cost: About $3,700 each for e-ink real-time bus timetables in Sydney

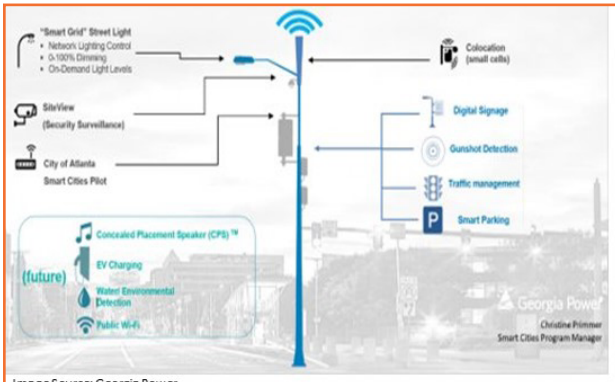


Image Source: Georgia Power

Image Source: https://vividcomm.com/2016/06/09/smart-street-lighting/

Solar and Smart Streetlights

Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

The smart streetlights implement multiple technologies at one location, including sensors for on-demand lighting, audio systems for public alerts, accident and traffic monitoring, potential electronic vehicle charging, parking assistance, signal management, and can also house roadside units.

Estimated Cost:

- Cost varies significantly based on functions and whether it is retrofitting an existing streetlight or installing a new streetlight;
- Retrofitting traditional streetlights could cost from $200 to $2,000 each, with another $150 for internet and network connections.

Image Source: RTInsights

Image Source: Hoodline

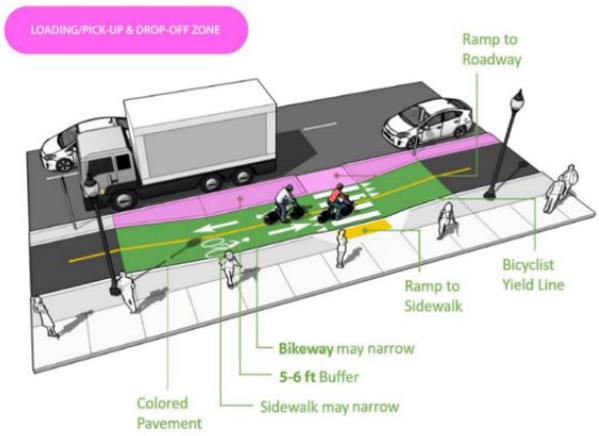
Trash Receptacle Sensors

Mobility | Parking | **Data / Information Sharing** | Connected & Autonomous Vehicles | Goods / Delivery

Description

Trash Receptacle Sensors track how much waste is in a trash bin and notifies the city of when they need to be emptied. The technology provides a reduction in cost of labor and collection as well as a reduction in the time it takes to collect and empty waste in cities.

Estimated Cost: About $300 each, including installation, parts, and three year's costs of maintaining and monitoring



Source: New Frontiers on the Street: Managing Your Curb Space in a Time of Mobility Disruption, Local Government Commission,

Curb/Lane Flexibility (Curbside Occupancy Sensors)

Mobility | **Parking** | **Data / Information Sharing** | Connected & Autonomous Vehicles | **Goods / Delivery**

Description

Curb/Lane flexibility is all about repurposing the parking and/or travel lane. Space for parking cars along the curbs could be transformed into a multi-use space that is adjustable based on a city's needs and goals. Usage can even change throughout the day; a loading zone in the afternoon (including micro-delivery), and a ride share drop-off space at night in an entertainment district. This is best paired with curbside occupancy sensors to provide information about usage through the day.

Estimated Cost: Cost can very based on curb distance and specific needs. Sensor and dynamic message signs can be used as well las smart meters. Those costs are included with those strategies.

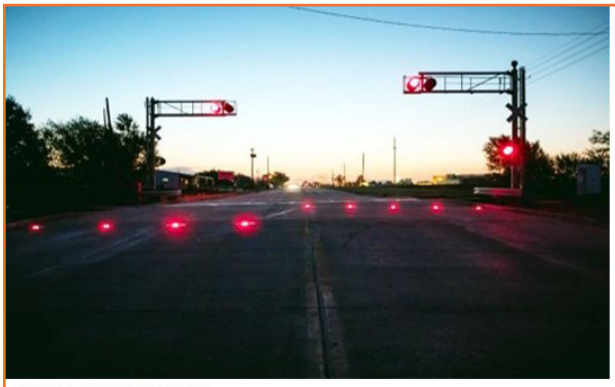


Image Source: LightGuard Systems

Image Source: BFT International

Illuminated Sidewalks

Mobility | Parking | **Data / Information Sharing** | Connected & Autonomous Vehicles | Goods / Delivery

Description

The in-pavement illuminated sidewalks and crosswalks are embedded with lighting systems that are oriented towards oncoming traffic and to provide a lit walking path for pedestrians and notify drivers that pedestrians are in the crosswalk.

Estimated Cost: A system with 10 In-Roadway Warning Lights, 2 signs, A/C power and push button activation starts at cost of $11,800, price could go higher for system upgrade and more functions.

Image Source: http://www.crossalert.com/system.html

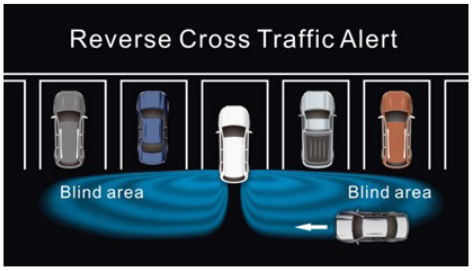


Image Source: https://rydeenmobile.com/product/bss2-radar-blind-spot-system/

Cross Alert Detection

Mobility | Parking | **Data / Information Sharing** | Connected & Autonomous Vehicles | Goods / Delivery

Description

The bicycle and pedestrian alert system is typically used at mid-block trail crossings to alert drivers of bicycles and pedestrians with flashing lights. The detection occurs through the use of sensors or radar. Similar technology could be applied in parking lots to notify drivers of vehicles behind them before backing out of the parking spot.

Estimated Cost: $2,000 - $20,000/location, additional costs depending on detection technology and/or existing controller capabilities

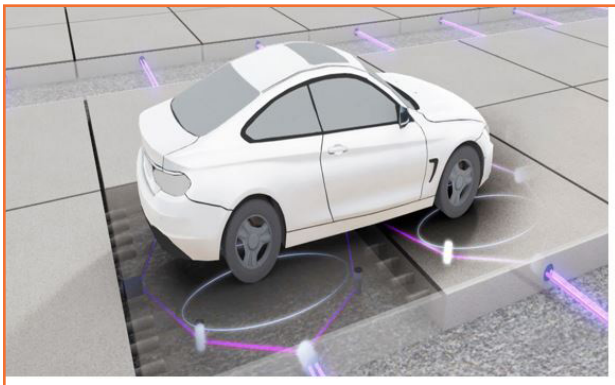


Image Source: Integrated Roadways

Image Source: Umbrellium

Smart Pavement and Sidewalks

Mobility | Parking | Data / Information Sharing | Connected & Autonomous Vehicles | Goods / Delivery

Description

The smart sidewalks and crosswalks are a responsive road surface that reacts in real time to traffic conditions. The technology uses LED-embedded plastic panels to display crossings, warnings, and other traffic indications. The smart pavement has an embedded sensor and network that communicates road conditions, traffic alerts, accidents and more to drivers

Estimated Cost: Averages about 4 million dollars per lane per mile, making this strategy largely infeasible until costs come down

Technology Evaluation and Strategies

Strategy Evaluation and Ranking

Each strategy was evaluated based on a set of eight performance themes, each with its own metric(s). The graphic below shows the evaluation framework and associated themes.

Community Input
Stakeholder input and community surveys used to determine the relative importance of the seven remaining performance themes.

Return on Investment & Economic Benefits
The number of jobs created.

Sustainable Technology
The technology's life span and capability of performing multiple tasks.

Safety
The technology's capability of improving safety conditions.

Project Readiness
The ease of implementation and ability to use available resources.

Mobility Options
The technology's general capability of improving the movement of people via driving, walking and bicycling.

Cost
The relative unit cost of the technology.

Environment & Public Health
The technology's general capability of improving air quality and active transportation conditions.

Each technology strategy was evaluated against each metric and assigned a low, medium, or high score. These qualitative scores were then associated with a quantitative score such as 1, 3, and 5, respectively. The table on the facing page lays out seven of the eight themes and the associated evaluation metrics, qualitative assignments, and associated point values.

Evaluation Metrics and Scores

Performance Theme	Metric	Qualitative Score	Point Value
Return on Investment & Economic Benefits	ROI Based on Jobs Created	Low	1
		Medium	3
		High	5
	Aesthetics	Low	1
		Medium	3
		High	5
Safety	Anticipated Crash Reduction	Low	1
		Medium	3
		High	5
Cost	Relative Cost	Low	5
		Medium	3
		High	1
Project Readiness	Telecommunica-tions-Ready	Low	1
		Medium	3
		High	5
	GDOT Permit Required	Yes	0
		No	2
	MUTCD-Compliant	Yes	5
		No	0
		N/A	5
	Can Use GDOT's Contract Vehicle	Yes	5
		No	0

Performance Theme	Metric	Qualitative Score	Point Value
Mobility Options	Improves Congestion	Low	1
		Medium	3
		High	5
	Improves Pedestrian Options	Low	1
		Medium	3
		High	5
	Decreases Use of Single-Occupancy Vehicles	Low	1
		Medium	3
		High	5
	Improves Data Use among Users and Stakeholders	Low	1
		Medium	3
		High	5
	Improves Travel Times	Low	1
		Medium	3
		High	5
Environment & Public Health	Anticipated Emissions Reduction	Low	1
		Medium	3
		High	5
	Active Transportation	Yes	3
		No	0
Sustainable Technology	Interoperability (communicates with most technologies)	Low	1
		Medium	3
		High	5
	Multi-functional	Yes	3
		No	0
	Low Maintenance (High = Best)	Low	1
		Medium	3
		High	5
	Not Likely to be Outdated within a Few Years (High = Best)	Low	1
		Medium	3
		High	5
	Monitors Infrastructure	No	0
		Yes	3

Once the technology strategies were scored, the final evaluation theme, Community Input, was applied through two weighting scenarios in which a weight was applied to each of the other seven themes. The two scenarios include the feedback from the Citywide Strategy Survey and the second was based on stakeholder input from City of Woodstock staff. The following table illustrates the two weighting scenarios by evaluation theme.

Evaluation Weighting Scenarios

Performance Theme	Scenario 1 (Survey Results)	Scenario 2 (City Staff Input)
ROI and Economic Benefits	20.0%	3.8%
Safety	25.0%	24.8%
Cost	15.0%	8.6%
Project Readiness	0.0%	13.3%
Mobility Options	25.0%	21.0%
Environment and Public Health	5.0%	9.5%
Sustainable Technology	10.0%	19.0%

Each technology strategy was ranked based on the evaluation results for each scenario. Scores for each technology strategy are included in **Appendix G**. These rankings were aggregated for a final ranking and placed into two tiers, Tier 1 and Tier 2. Tier 1 projects are considered the higher-performing strategies, while Tier 2 are lower-performing strategies. The graphics on the facing page demonstrate this evaluation process and the final strategy tiers.

Citywide Strategy Evaluation and Results

Downtown Corridor Strategy Evaluation and Results

Citywide Strategies

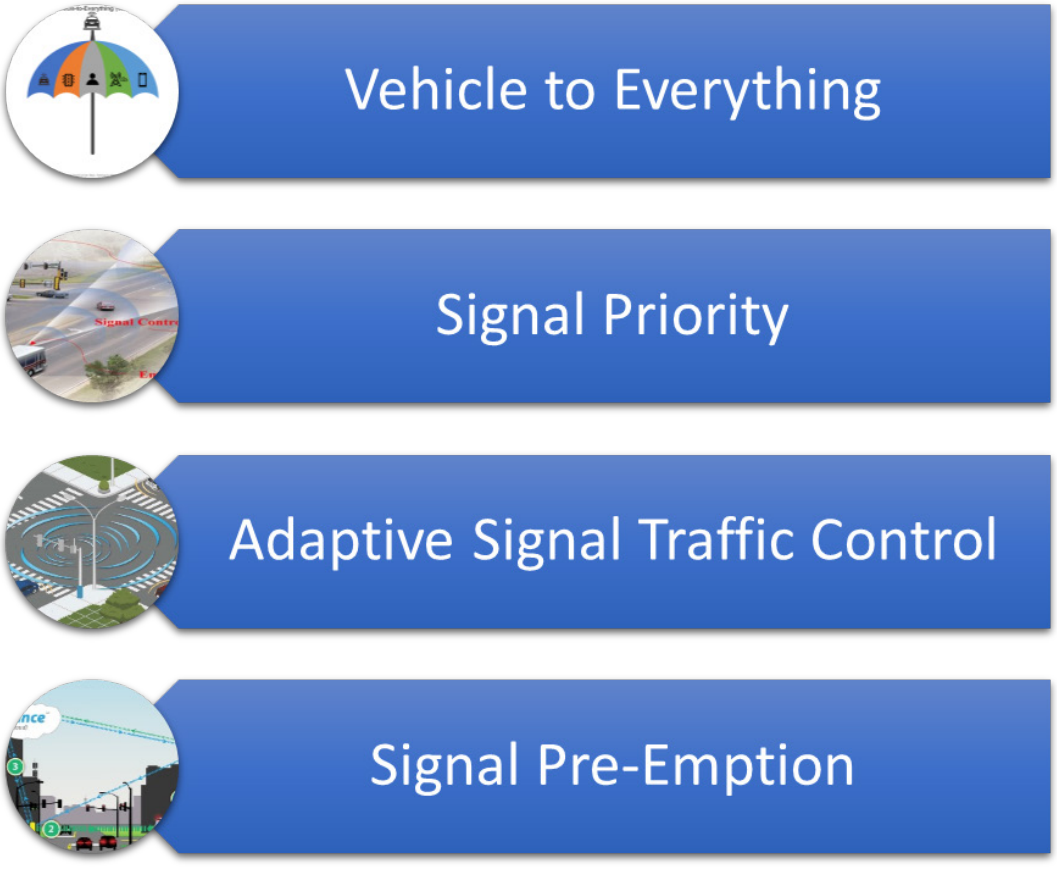
Based on the work done in establishing the universe of potential technologies and in the evaluation process, Tier 1 and Tier 2 Citywide Strategies were identified. In addition to these specific Citywide Strategies, additional policy concerns were explored by other partners in this project. Some of these, including privacy concerns and funding opportunities, are documented in the "Smart Woodstock Research Guide and Smart Cities Playbook," included in **Appendix H**.

Tier 1 Citywide Strategies

The Citywide strategies that show the highest performance and which should be considered for implementation in the near-term are outlined in the following graphic and include, in no particular order:

- Adaptive Signal Traffic Control (shown on page 21),
- Signal Pre-Emption (shown on page 22)
- Signal Priority (shown on page 21)
- Vehicle-to-Everything (shown on page 22)

Tier 1 Citywide Strategies



Tier 2 Citywide Strategies

The Tier 2 strategies are those that do not demonstrate as high performance as Tier 1 but should still be considered for implementation in the mid- and long-term. However, if an opportunity arises to implement one or more of these strategies due to shifting in City priorities or funding availability, these projects could be implemented sooner. Tier 2 Citywide Strategies include:

- Autonomous Micro-Mobility (shown on page 19),
- EV Charging Stations (shown on page 20), and
- Roadside Sensors (shown on page 20).

Tier 2 Citywide Strategies

Roadside Sensor

Autonomous Micro-Mobility

EV Charging Stations

Downtown Strategies

The top-scoring Downtown Strategies are presented here in two tiers, identified in a similar way to the Citywide Strategies.

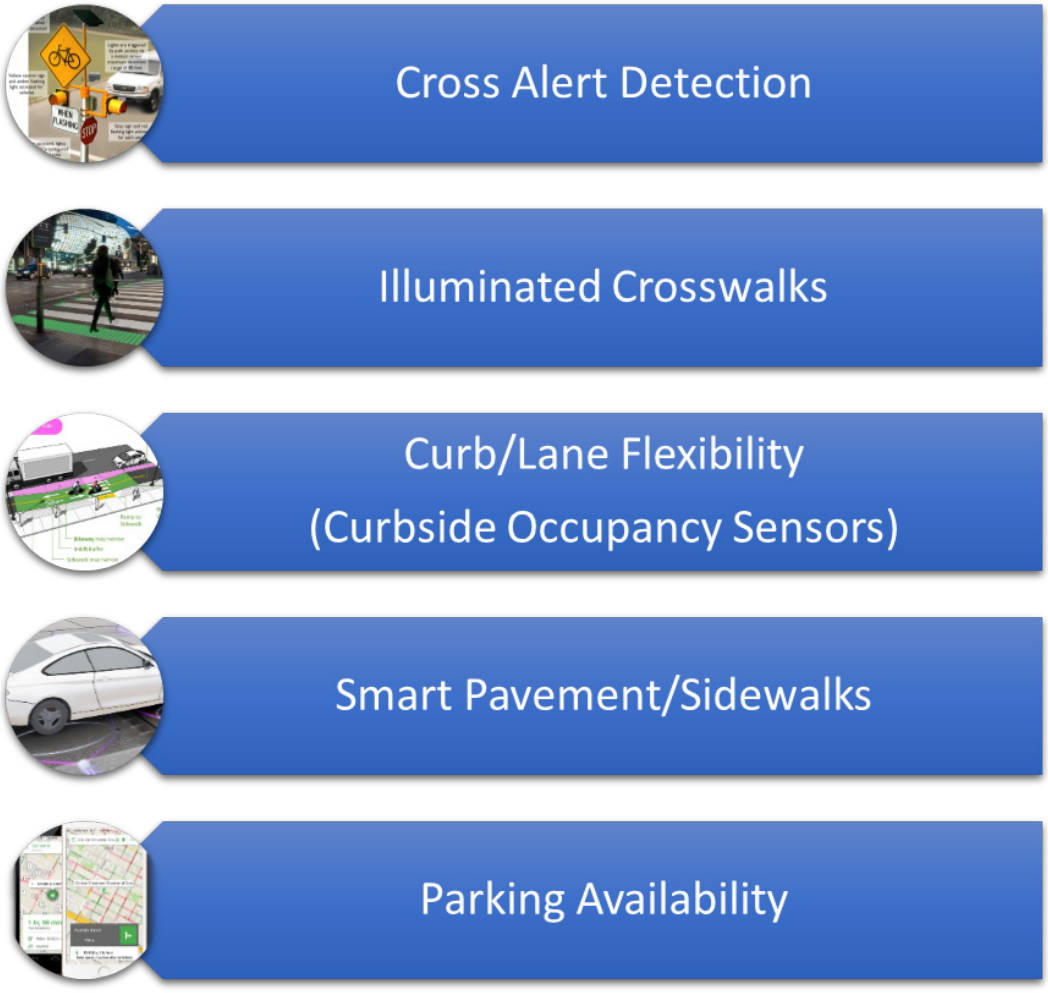
Tier 1 Downtown Strategies

The Downtown Strategies with the highest alignment with stakeholder input are:

- Cross Alert Detection (shown on page 26),
- Curb/Lane Flexibility (shown on page 25),
- Illuminated Crosswalks (shown on page 26),
- Parking Availability (shown on page 23), and
- Smart Pavement/Sidewalks (shown on page 27).

Pilot projects and associated potential funding sources that speak to the Illuminated Crosswalks, Curb/Lane Flexibility, and Parking Availability are included in **Appendix H**, along with the "Smart Woodstock Research Guide and Smart Cities Playbook" developed as part of this overall project. These pilot projects were selected by the project team and are anticipated to be among the first smart technology projects considered and implemented by the City.

Tier 1 Downtown Strategies



Tier 2 Downtown Strategies

Tier 2 Downtown Strategies include:

- Curbside Occupancy Sensors (shown on page 25),
- Electronic Ink Signs (shown on page 24),
- Smart Parking Meters (shown on page 23),
- Smart Streetlighting (shown on page 24), and
- Trash Receptacle Sensors (shown on page 25).

Tier 2 Downtown Strategies

Citywide Smart City Policies

Through this process, the following policies have been developed in addition to the specific technology strategies as a potential way to guide the implementation of all smart technologies in Woodstock. These policies were developed through brainstorming and refinement between the consulting team and the City team, based on the broad community input received and conversations had with City staff and other stakeholders. These policies could apply to both those strategies identified here (both Citywide and Downtown) and to any new types of technologies identified for potential implementation in the future.

Smart Policy 1: Develop and Maintain a Smart Technology Working Group

As opportunities increase to integrate smart technology into city operations and initiatives discussed in both the Citywide strategy and Downtown strategy are implemented it will be critical to have a working group within the city for future decision making. An early version of this group could be City staff of various departments focused on implementing the Tier 1 initiatives identified in this report, with regular, recurring meetings focused on that implementation. Likewise, the surveying, goal setting, and evaluation processes described in this plan can act as a starting point of community vision coupled with a pragmatic data-driven approach for decision making and investment prioritization.

Future evolutions of this group may include a larger, more complex structure for more advanced decision making. This group may eventually include further integration with elected officials, stakeholder outreach to city residents and businesses, and additional staff dedicated specifically to smart technology.

Smart Policy 2: Develop a Framework for Data Collection, Management, Sharing, and Communication

Because smart technology is broad and continues to evolve, many of its potential benefits remain in the early stages of understanding and in some case may remain unknown at this time. Nonetheless, such technology will likely offer opportunities for maintenance and a host of monitoring activities (including activities as diverse as infrastructure

and law enforcement). Therefore, the working group should establish an initial framework for what data can be collected and how it would potentially be managed and maintained. This should include an initial inventory of all City and partner programs that generate real-time data, identification of any partner government (County, regional, etc.) data repositories, and - where applicable - consideration of how reporting may be appropriate to reinforce the City's commitment to transparency. Such reporting may also include the identification of appropriate and clearly defined metrics and performance indicators. A secondary benefit of such reporting is the potential for publicly available dashboards that can track and report key city initiatives.

Interfaced with both the collaboration and communication components of this policy is the need to develop policies for data sharing. A framework should be developed to establish standards for data-sharing within internal City departments for special events, road construction, emergency management, and other assorted collaborations as well as data-sharing with external partners such as Cherokee County, GDOT, Cherokee County Schools, the Atlanta Regional Commission, and others.

Smart Policy 3: Develop Smart Technology Security and Privacy Policies

Establishing preexisting and consistent policies to ensure both data security and privacy will be critical to maintaining public trust. Such policies should clearly describe and establish how the collection and use of smart technology data is for the 'public good' describing what data will be used, why it will be used, how it will be used, and a process for public recourse and compliance verification.

Smart Policy 4: Develop Internet-of-Things (IOT) Standards

The implementation of smart technology throughout the City of Woodstock will require the early establishment of Internet of Things (IOT) standards and the development of an approval process for smart technology proposals. Such considerations are likely to include:

- Design standards for technologies that are installed in the public realm
- Standards for how multiple providers may work in the same space
- Identification of locations appropriate (and not appropriate) for installation