Smart Mobility Plan

Technical Memorandum – Final Report

Hillsborough Transportation Planning Organization (TPO)

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Acronyms

ATM	Arterial Traffic Management
ATMS	Active Traffic Management Systems
AV	Autonomous Vehicles
BPAC	Bicycle/ Pedestrian Advisory Committee
CAC	Citizens Advisory Committee
CCC	Chairs Coordinating Committee
CO	Colorado
CV	Connected Vehicles
GIS	Geographic Information System
HART	Hillsborough Area Regional Transit Authority
ICM	Integrated Corridor Management
ICT	Information Communication Technology
ITS	Intelligent Transportation System
LRC	Livable Roadways Committee
LRTP	Long Range Transportation Plan
MaaS	Mobility as a Service
QoL	Quality of Life
SPaT	Signal Phase and Timing
TAC	Technical Advisory Committee
TDCB	Transportation Disadvantaged Coordinating Board
TDM	Travel Demand Management
THEA	Tampa Hillsborough Expressway Authority
TIM	Travel Incident Management
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TPO	Transportation Planning Organization
WA	Washington

1. Executive Summary

This Smart Cities Mobility Plan represents the first phase by Hillsborough TPO's in identifying technologies which may address transportation needs, encouraging their consideration during the project planning phase, and prioritizing Smart Cities deployments to achieve the TPO's long-term vision. The second phase will commence shortly, building on the recommendations of this report and the identified next steps, this will enable the TPO to develop detailed implementation plans to achieve the vision within the 2045 Long Range Transportation Plan.

Throughout this project, both within the Discovery Phase and the Analysis Phase, there has been extensive engagement with stakeholders, this includes regional public agencies and the citizens of Hillsborough. This engagement was considered critical as some of the technologies could generate strong feelings and therefore, earlier engagement, education and conversations help to address myths and concerns.

The output of this phase of the project enables the TPO to focus and provide proactive investment in the Transportation Improvement Program under the TPO's Smart Cities investment program.

In conclusion, the recommended to the Board are outlined below:

1. The following Vision Statement is adopted to act as framework to guide planning and development smart cities projects and initiatives.
2. To intelligently deploy the latest Smart City technologies to allow for monitoring, assessment, and management of the transportation network.
3. To translate performance insights into action and provide safe, efficient, convenient, and equitable transportation options across Hillsborough County.
4. Plan for deployment of the highest-ranking projects identified via the Gap Analysis and included in the Table 6-2 - Technology Mapping.
5. Use the Prioritization Matrix to more appropriately score smart city related projects as part of the TIP.
6. Increase funding for the smart cities program in order to enable delivery of the 5 goals (e.g., Digital Inclusion).
7. Utilize the Smart City Fact sheets (by all partner agencies) to engage and inform the general public.

The next steps for Phase 2 are:

1. State of the Practice: building on the findings in phase 1, we will develop a State of the Practice to study other local and global Smart Mobility Plan components.
2. Smart Mobility Plan Capability Maturity Model (CMM) Workshop: facilitate workshops to identify and benchmark the current level of maturity in Smart Mobility strategies. Drawing from the FHWA CMM framework and prior to the workshops, we will work with Hillsborough TPO to identify the dimensions to be assessed. We will then develop survey questionnaires under each dimension and undertake workshops to identify current level of Smart Mobility maturity and perform gap analysis.
3. Development of Smart Mobility Plan Vision, Mission, Goals, and Objectives (Smart Mobility Elements): based on the findings from the CMM workshop, we will facilitate meetings and workshops to share findings and identify Hillsborough Smart Mobility Plan goals and objectives accordingly. This will be performed in alignment with existing goals and objectives to demonstrate how the new goals and objectives are complementing the existing ones.
4. Implementation Plan (Roadmap): under each CMM category and in alignment with identified goals and objectives, we will develop a set of action items with associated time frames. Action items may include multiple activities such as development of new processes and procedures, plans and programs, partnerships, new policies, list of technologies, etc. based on the

stakeholders' feedback and in order to bridge the gap between existing conditions and the Plan's vision. As part of this task, we will also develop steps to be undertaken in order to improve capabilities under each CMM dimension.

5. Performance Measurement: to enable a data-driven and performance-based approach in managing and implementing Smart Mobility projects, we will develop a performance measurement framework to assist Hillsborough TPO identify targeted areas and prioritize projects accordingly. In this process, we will also leverage the prioritization matrix that was established as part of Phase 1.
6. Final Plan: development of the Hillsborough Smart Mobility Plan document, including the findings from steps 1 to 5.

2. Introduction

This introduction provides an overview of the project scope for Hillsborough Transportation Planning Organization (TPO) Smart Mobility Plan.

In line with state and national trends, the Hillsborough TPO is exploring possibilities to advance the use of existing and emerging technologies more aggressively across its planning area. Both existing and emergent technologies may help improve mobility both within the county and across the region. Mobility technologies have traditionally been prioritized for investment in the Transportation Improvement Program (TIP) under the TPO's Smart Cities investment program.

The feasibility of deployment and benefits of mobility technologies was also evaluated as part of the 2045 Long Range Transportation Plan (LRTP) update. The LRTP casts a long-term vision of Hillsborough County and establishes investment criteria and details transportation priorities and associated funding over the next 25 years. The plan identifies five investment programs corresponding to critical transportation needs as shown in Figure 2-1 - Hillsborough TPO Core Investment Areas:

Figure 2-1 - Hillsborough TPO Core Investment Areas

Each of the five investment program categories are supported by a goal statement, a methodology for measuring current levels of performance, and targets to be achieved. It is important to note that while one of the core investment areas is entitled *Smart Cities*, mobility technologies have traditionally comprised a small proportion of the projects prioritized under this category. The 2021 List of Candidates for Funding, for example, included 13 priority projects under the Smart Cities category and only 4 projects specifically called for the deployment of a transportation technology.

Development of a clear 5-year Smart Cities vision and supporting road map is critical to thoughtfully guide deployment of technologies which may help achieve the goal statement described in the Smart Cities section of the 2045 Long Range Transportation Plan. As the TPO and implementing agencies continue to seek investments in Smart Cities solutions, an appropriate methodology for prioritizing investments will be required.

This Smart Cities Mobility Plan clarifies the Hillsborough TPO's role in identifying technologies which may address transportation needs, encouraging their consideration during the project planning phase, and prioritizing Smart Cities deployments to achieve the TPO's long-term vision. The Smart Cities Mobility Plan will be delivered in two phases: the activities completed in Phase One are summarized below and the results of the planning process are detailed in the sections which follow. A Phase Two is expected to follow. The staggered approach to scoping a

comprehensive Smart Cities Mobility Plan will ensure that feedback from local partners and the public, particularly regarding the TPO's role in facilitating project development, will be appropriately considered.

2.1. Phase One

2.1.1. A) Discovery

The discovery phase accomplished two objectives:

1. First, a horizon scanning procedure and industry literature review was completed to identify current Smart Cities practices and technologies. Studying how various jurisdictions deploy technologies, both domestic and abroad, allowed us to learn how public and private entities are approaching Smart Cites planning efforts and developing deployment strategies. The practices were then mapped against the TPO's five investment programs and supported by case studies which demonstrate each technology's benefits, special considerations, lessons learned, and any equity concerns, including privacy, surveillance, enforcement, and others.
2. Second, a baseline of current technology deployments was informed by the horizon scan and further developed with input from local stakeholders and agency partners. The products are a State of the Practice document covering the entire Hillsborough Metropolitan Planning Area, a map showing existing Smart Cities deployments, and a vision map developed in consultation with local stakeholders to guide and inform future deployments, the full details of these can be found in the Discovery Phase deliverable and summarized in Table 6-2 - Technology Mapping.
3. Third, a Prioritization Matrix (Figure 8-1 - Prioritization Matrix - Assessment Criteria) was developed to allow the TPO to evaluate, score, and comparatively rank Smart Cities projects for inclusion in both the Transportation Improvement Program and Long-Range Transportation Plan, the Prioritization Matrix provides a process for better incorporating Smart Cities technology projects into the existing 'Smart Cities' investment program was drafted and will need to be considered by both TPO staff and Board.

In completing the Discovery process, a toolkit was created for the purpose of considering future deployments. Each technology that was identified in the horizon scan was considered and then mapped using a numerical scale to indicate the magnitude of potential benefits ranging from 1 (low) to 10 (high), as well as color-coded to indicate which of the five investment programs (e.g., in the table below magenta for smart cities) will be impacted by the technology. Technologies were then classified as follows: 1. technology solutions that are currently utilized in the county; 2. existing technology solutions that are not currently utilized; and new & emergent technology solutions that may be beneficial. In addition to the classification schema, approximate costs of deployment were estimated for each based on previous experience and case studies programs (e.g., in the table below $$$ signs denoting cost scale), where available. Table 2-1 - Initial Technology Toolkit below is a sample for illustration purposes only:

Table 2-1 - Initial Technology Toolkit

Existing technology solutions we have	Existing technology solutions we do not have	New & emergent technology solutions
active traffic management, 8; $$$	flood detection sensors, 4; $$	predictive analytics
Integrated Corridor management, 7; $$$	micro-mobility, 5; $	blockchain
signal retiming & coordination, 6; $	connected vehicles	5G communications
vehicle detection and tracking	autonomous vehicles	
incident management	virtual curb-side management	
journey planning	mobility as a service	
performance management		
big data		
traffic signal prioritization		
fiber communications		
parking technologies		

2.1.2. B) Analysis

The Analysis process utilized the outputs from the Discovery process as follows:

1. The current & planned technology deployments were mapped in the TPO's GIS; and,
2. Individual, one-on-one planning meetings were held with agency partners in lieu of a stakeholder workshop. Private, virtual meetings were preferred out of caution regarding Covid-19 transmissions. The planning meetings included both planning and engineering staff and, in many cases, traffic operations teams. During each meeting, partners were asked to identify transportation facilities performing poorly in one or more of the five investment program categories and to both identify any technological solutions currently utilized, and to consider a range of Smart Cities solutions which may have a positive impact upon the need. Where appropriate, partners were educated about new and emergent solutions which may prove useful to improve performance. The product of these meetings was a vision map and list of potential projects to consider funding over the next five years.
3. An in-person workshop with TPO staff and key staff from partner agencies was cancelled, again, due to caution regarding Covid-19 transmissions. Rather than hosting an in-person workshop, two webinars were hosted over Zoom and included staff from the TPO, Planning Commission, partner agencies, and were open to the general public. The output of these webinars was a list of potential projects to consider for deployment and to test the validity of the prioritization matrix.
4. The potential projects identified above were then assigned a score using the prioritization matrix developed from case studies and existing plans. The goal of the prioritization matrix is to allow TPO staff to better evaluate Smart Cities projects submitted as priorities for federal and/or state funding. The matrix includes performance criteria aligning with the five investment programs, potential benefits to each investment program, and planning-level cost estimates. The specific criteria included in the matrix were refined according to feedback received during one-on-one meetings with key staff from partner agencies.

2.1.3. C) Public Outreach

While not originally included in the scope of work, it was determined during an early project meeting that receiving public feedback regarding the deployment of specific technologies may be desirable. Recognizing that some technologies may generate public apprehension or distrust, the project team decided to produce engagement materials, including PowerPoint presentations and a survey, to gauge public attitudes toward Smart Cities technologies and use it as an opportunity to educate and answer questions. In the context of several simmering controversies regarding due process, constitutionality, and racial bias of red-light running cameras, it was decided that several "controversial" technologies should be presented to the public for consideration. In order to receive the desired feedback, topical presentations were delivered to the public and a special emphasis was placed upon engaging historically underserved communities. This outreach activities designed to accomplish this included:

1. Presentations to 8 classes at Tampa Bay Technical High School during the Great American Teach-In on November 19, 2020. Due to the Covid-19 pandemic, virtual presentations were made, and online surveys were circulated to students, their parents, and teachers.
2. An abbreviated version of the online survey was made available in Dec 2020 and has been collecting responses throughout the duration of the plan.
3. A webinar on the topic of Smart Cities was presented at Plan Hillsborough's Info BBQ (Brown Bag Quarterly) on July 22, 2021, to an audience of approximately 30 people. The presentation was later uploaded to YouTube: https://www.youtube.com/watch?v=DMxCLoFe9gY
4. An article was published in Plan Hillsborough's August "Connections to Tomorrow" monthly newsletter. The article directed readers to complete the survey, review plan materials and documentation and provide comments to TPO staff.
5. Further information can be found on the internet at: http://www.planhillsborough.org/smart-cities-mobility-plan-will-improve-transportation-planning-with-technology.

Responses from the online survey are provided in Appendix A. Appendix A. On-Line Survey

3. Engagement

Outlined Below is a summary of the various meetings, ITS committees, Tampa Bay Smart Cities Alliance, Schools and the Questionnaire results oriented toward transportation professionals and key staff from partner agencies:

1. The plan was presented to the Tampa Bay Smart Cities Alliance on July 1, 2021 to an audience of approximately 45 people.
2. A plan update was presented to the TPO Intelligent Transportation Systems (ITS) committee on July 8, 2021.
3. A webinar on the topic of Smart Cities was presented at Plan Hillsborough's Info BBQ (Brown Bag Quarterly) on July 22, 2021, to an audience of approximately 30 people. The presentation was later uploaded to YouTube: https://www.youtube.com/watch?v=DMxCLoFe9gY
4. An article was published in Plan Hillsborough's August "Connections to Tomorrow" monthly newsletter. The article direction readers to complete the survey and to review plan materials and documentation and provide comments to TPO staff.
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As part of the project wrap up for Phase 1, a series of one-on-one meetings were conducted with partner agencies to provide feedback on the Phase 1 deliverables, seek feedback on the Prioritization Matrix assessment criteria and to understand the level of support from the agencies to the project and its progression into Phase 2.

A number of agencies provided letters of support that can be found in Appendix B Appendix B. Letters of Support.

The coordination meetings proceeded with planning and engineering staff to allow for a diversity of feedback.

4. Research Sources and Process

A comprehensive review of Smart City plans, programs and guidance documents was conducted to determine the state of the practice with regard to Smart City planning and deployment efforts nationwide and globally as part of the Discovery Phase. The sources include plans and documents from more than 100 cities, as well as vendors website, and stakeholder feedback. A comprehensive list of the sources is provided in the bibliography section of this document.

Prior to conducting the research, a set of guidelines were developed to establish a structured framework for a focused review of Smart Cities Elements in both local and global efforts. As described previously, these elements were developed with respect to Hillsborough TPO's core investment programs, as well as additional elements recommended within Smart Cities guidance documents as follows:

1. Existing and Emerging Technologies
2. Investment Criteria (funding plans)
3. Strategic/ Transportation Priorities
4. Planning/ Deployment Duration
5. Benefits
6. Collaboration
7. Infrastructure (physical and digital)
8. Performance Measurement and Management

The next step was to develop the Special Considerations Elements. Drawing from the Smart Cities Elements, the following set of criteria was used to establish a prioritization framework for Smart Cities technology deployments within the Hillsborough Smart City Mobility Plan. It should be noted that while not all Smart Cities technologies pertain to transportation, the focus of this effort was on mobility and/or mobility enabling technologies.

1. Cost
2. Risks
3. Dependencies
4. Return on Investment
5. Benefit Cost Ratio
6. Alignment with Goals and Objectives
7. Implementation Timeframe
8. Strategic Value(s)
9. Equity

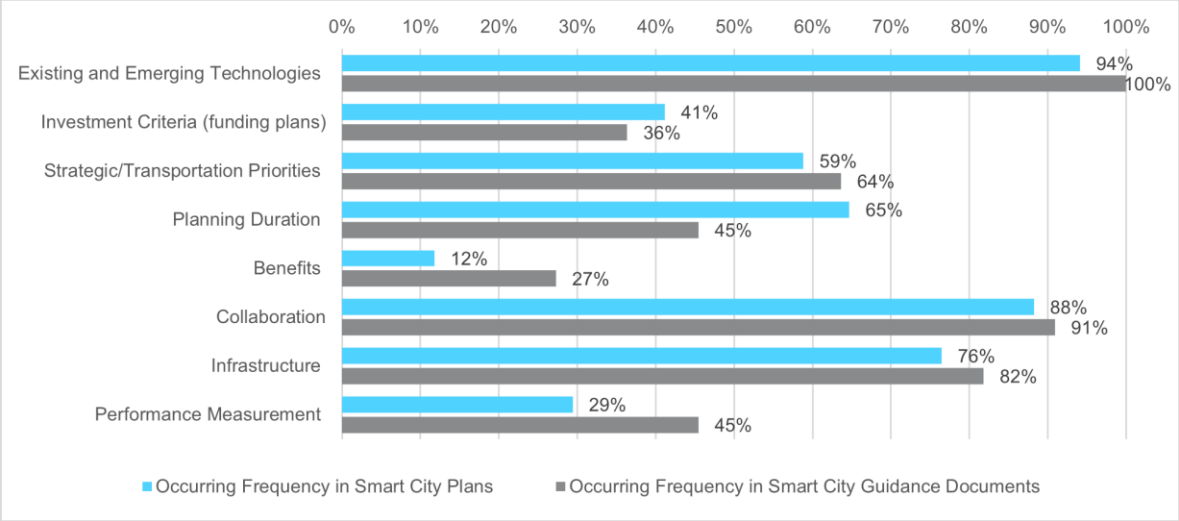
A state of the practice matrix was developed to perform quantitative reviews and analysis on relevant components of each source in alignment with the Smart Cities and Special Considerations Elements described in Section 3. The findings and analysis of reviews are included in the following sections of this document.

5. Discussion of Findings

5.1. Smart Cities Elements

State of the practice reviews were performed as part of the Discovery Phase using the approach described in Section 4 Research Sources and Process. Figure 5-1 - Occurring Frequency of Smart Cities Elements demonstrates a comprehensive summary of findings through discussing the occurring frequency of Smart Cities Elements in guidance documents versus plans, programs, and initiatives.

Figure 5-1 - Occurring Frequency of Smart Cities Elements

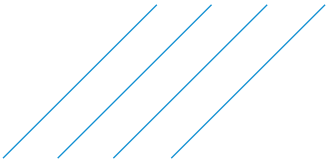


As shown in Figure 5-1 - Occurring Frequency of Smart Cities Elements, Existing and Emerging Technologies, Collaboration, and Infrastructure are the top three elements addressed in both planning and guidance sources. The reviews also demonstrate that there is less focus on discussions of Investment Criteria (funding plans) and Planning Duration elements within Smart Cities planning documents compared to guidelines. Another finding of these analyses is that the Benefits were the least discussed in both planning documents and guidelines. However, with over 50% of sources dedicating a great focus to Strategic/ Transportation Priorities, it can be concluded that identifying technology deployments based on Strategic/ Transportation Priorities is a more essential element as opposed to the general benefits that can be achieved through technology deployments.

The following sub-sections provide a more in-depth discussion of findings and analysis on Smart Cities Elements.

5.1.1. Existing and Emerging Technologies

The existing and emerging technologies element has been identified as the most discussed element within reviews of different sources, highlighting the importance of technology and Information Technology (IT) in development of Smart Cities strategies and initiatives. The reviewed sources include discussions related to existing, planned and emerging technology deployments. Some sources also embrace strategies for integrating the existing systems into planned and emerging technologies; however, others focus on development of an implementation plan for emerging technologies only. Based on the reviews conducted, the decision to integrate the existing systems depends on several factors such as the strategic direction, the maturity, interoperability and compatibility of the existing systems, and the funding required for the integration. Some sources



also discuss the required level of collaboration and coordination with stakeholders as a challenge to achieve efficiency in integration.

Even though the elements must be assessed on a case-by-case basis, the Smart Cities guidance sources encourage maximizing the efficiency of the available and existing technologies through integration with emerging and planned technologies (CITA, 2019) (Getting Smart About Smart Cities, 2017). Hillsborough TPO is currently in process of identifying opportunities for integration of existing and emerging technologies to maximize efficiency.

5.1.2. Investment Criteria (funding plans)

The reviews indicate unique approaches in the required investment criteria and funding plans based on the cities' funding strategies. Some sources include one or multiple investment elements to assist with deployment of Smart City initiatives, while others have taken a step further and developed funding plans for future deployments and discussed details of available funding versus future funding and challenges. Some specific investment strategies and funding plans include Major and Minor Capital plans; Short, Mid and Long-term funding plans; and ITS Master Plans. The City of Bellevue, Washington (WA) undertook a more detailed approach and identified Existing Investments versus New Investments, as well as identifying other funding sources such as grants, public-private-partnerships, competition prices and revolving loan programs (Bellevue Smart, 2017). Hillsborough TPO has established funding requirements within the 2045 LRTP and will leverage the available resources in the next phase of this study.

5.1.3. Strategic/ Transportation Priorities

To develop a targeted roadmap for technology deployments, a majority of sources have included strategic priorities and/or transportation priorities, such as safety, mobility, and sustainability, to assist in development of a phased approach in achieving goals and objectives. In some cases, Strategic/ Transportation priorities are directly mapped against technology deployments, while others have only listed these priorities without discussing this relationship. The review of Smart Cities guidance documents indicates a substantial significance on ensuring the planned strategies, whether technology related or not, be assessed against the vision and strategic goals and objectives of the Smart City. This will ensure efforts are in alignment with local and regional priorities of stakeholders and citizens, enabling a thoughtful allocation of resources in a targeted manner.

Prior to the selection of specific strategies and technologies, it is recommended to achieve a local consensus for Strategic/ Transportation priorities. For example, Boulder, Colorado (CO), organized workshops with a wide range of participants, including internal departments, private sector, universities, and federal laboratories to discuss transportation priorities and develop a shared vision for the use of Smart City technologies (Getting Smart About Smart Cities, 2017). The State of the Practice reviews indicate that this element is one of the most frequent discussed topics within the current Hillsborough MPO initiatives.

5.1.4. Planning/ Deployment Duration

The majority of reviewed sources have established a roadmap or timeline for deployment of Smart City initiatives. Some sources have also developed roadmaps based on the location of deployments within the city. This has helped with integrating deployment roadmaps with transportation priorities specific to certain areas and communities. A clear and well-defined implementation approach will also assist in identifying how the Smart City plan initiatives and projects fit into other regional plans and therefore, helps avoid reinventing the wheel through leveraging resources and alignment of goals and objectives (CITA, 2019). The TPO TIP prioritizes transportation investments over a period of 5 years, and so a project with a deployment timeline of 5 years or less would be preferable in order in meets the TIP timelines and delivers near term benefits.

5.1.5. Benefits

The reviews indicated that including specific analysis to establish a better understanding of how the city will benefit from Smart City deployments will ensure and clarify how the benefits are aligned with the identified goals, objectives, and transportation priorities. Even though the Benefits element is the element addressed least within planning and guidance documents, understanding the benefits of specific initiatives and strategies will assist in a more efficient and accurate prioritization when developing an implementation roadmap.

5.1.6. Collaboration

The collaboration element refers to several types of collaboration including with stakeholders, vendors/industry, and citizens. The majority of sources focus on the importance of collaboration with stakeholders and citizens, while some also highlight the importance of establishing relationships with vendors and private industry.

As the second most discussed element within the reviewed sources, Collaboration helps cities establish and achieve a connected community, strengthen the relationships between key players, coordinate and balance agency operation and enable the cultural shift required for maximum integration. The San Diego Smart Cities Regional Initiative has helped the city transform the approach in providing services and has had a major impact on the regional social, environmental and economic development (CITA, 2019). Based on the State of the Practice findings, Collaboration is a key element discussed in the majority of Hillsborough TPO programs and initiatives.

5.1.7. Infrastructure

This element includes discussions of both physical and digital infrastructure. Physical infrastructure refers to the physical structure, equipment, and transportation infrastructure. Digital infrastructure refers to the functional elements such as data, communication, and technology systems that are necessary to the IT capabilities. The majority of sources highlight the importance of considerations for both physical and digital infrastructure as the emerging technologies typically include several IT elements.

As the third most discussed topic within the reviewed sources, establishing a profound understanding of the existing and required infrastructure, whether physical or digital, is critical in determining where to start and how to maximize the efficiency of the existing infrastructure and resources. Reviews indicate that infrastructure needs are considered in TPO's planning processes.

5.1.8. Performance Measurement and Management

To ensure a data-driven and performance-based approach in deployment, operation and maintenance of Smart Cities strategies and initiatives, and to accurately measure performance against the established targets, some sources have developed specific performance measures in alignment with the strategic goals and objectives. These performance measures could be either specific to Smart Cities strategies and initiatives or defined as part of the Smart City Maturity Model framework to effectively measure and advance Smart Cities' efforts in different areas.

The Reynolds Landing, a smart neighborhood in Birmingham, Alabama, is utilizing smart home technology provided to the homeowners to help them measure and track energy use around the home, thereby providing insight through data visualization on costs both by room and by appliance in real time with the ability to track historical trends. This is empowering the community with the required knowledge to both increase efficiency and minimize energy waste (CITA, 2019).

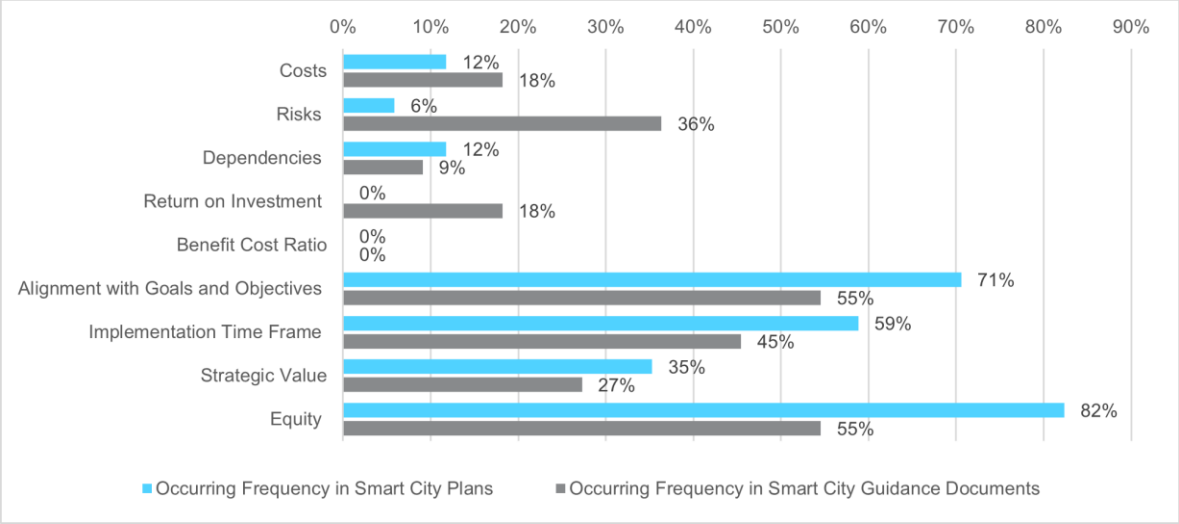
Bellevue Smart has utilized the Smart City Maturity Model and has developed a maturity index for each one of the Smart Cities' elements, including Connectivity, Transportation, Public Safety, Water, Buildings, and Energy. This has helped the city benchmark the current state of the practice, as well as identifying areas of strength and opportunities and the specific actions required to move to the next level of maturity through performance measurement. Several current plans, programs,

and initiatives currently consider and discuss a performance measurement methodology by the Hillsborough TPO.

5.2. Special Considerations

Using the same approach, a state of the practice review was performed to identify the occurring frequency of Smart Cities Special Considerations Elements in guidance documents versus plans, programs and initiatives. Figure 5-2 - Occurring Frequency of Smart City Special Considerations demonstrates a comprehensive summary of findings.

Figure 5-2 - Occurring Frequency of Smart City Special Considerations



As previously discussed, the Special Considerations Elements were developed to establish a framework for prioritization of Smart Cities' strategies and technology deployments. As shown in Figure 5-2 - Occurring Frequency of Smart City Special Considerations, Alignment with Goals and Objectives, Equity, and Implementation Timeframe are the top three elements addressed in prioritizing projects and initiatives.

Despite the moderate significance of understanding the Risk associated with technology deployments in Smart City guidance documents, this element has been identified as the least discussed within the Smart City plans, programs, and initiatives.

Similarly, Return on Investment was another element addressed in some sources as an element to consider, but not utilized in any of the plans. Another interesting finding was that, despite the importance of understanding the Benefit Cost Ratio of technology deployments for resource allocation, the element was not directly addressed in neither the plans nor the guidance documents. However, in some sources, through the different deployment approaches such as pilot projects and test corridors, Benefit Cost Ratio was utilized in the analysis of the next steps and to identify whether the deployment is scalable.

The TPO recognizes the importance of a performance-based approach, ensuring a focus on benefits and outcomes rather than the specific technology deployment. Therefore, even though these two elements were not addressed within the reviewed sources, the recommendation is to maintain these elements within the prioritization framework.

5.3. Hillsborough TPO State of the practice

Using the same approach, the current local practice, plans, programs and initiatives were reviewed to compare the findings against global practices. Analyses were performed on both Smart Cities

Elements and Special Considerations Elements. The following sections describe the findings of these reviews.

The TPO highly values the ability to quantify benefits of transportation investments. Without a definitive guide for how to calculate benefits of emerging technologies, the ranking criteria in the prioritization matrix may need to be adjusted periodically to reflect new developments in this space.

5.3.1. Review of Local Plans, Projects, and Initiatives

In December of 2017, a group of transportation professionals met for the first time to discuss ways that the Tampa Bay region could be propelled forward as an inclusive, collaborative, and cutting-edge Smart City. The group would eventually come to be known as the Tampa Bay Smart Cities Alliance and declare its mission to be brainstorming innovative projects and seeking grants to deploy technologies. In the five years since the Alliance was created, it has served as a major incubator for Smart Cities transportation solutions and many of its initiatives are gaining traction across the region. The following is a list of local plans, projects, and initiatives that were reviewed to establish a comparative baseline between local Smart Cities initiative and global initiatives:

- Mobility as a Service (MaaS)
- Reimagining Infrastructure
- Regional Data Platform
- Tampa Hillsborough Expressway Authority (THEA) Connected Vehicle (CV) pilot
- Hillsborough Area Regional Transit (HART) Autonomous Vehicle (AV) Shuttle Pilot
- Smart Work Zones
- 2045 LRTP
- ITS Master Plan
- All-Electronic Tolling and Green Spaces Improve the Tampa Bay Region

Figure 5-3 - Occurring Frequency of Smart Cities Elements Total vs Local and Figure 5-4 - Occurring Frequency of Special Considerations Elements Total vs Local demonstrate the findings and the occurring frequency of defined elements addressed within local practices.

Figure 5-3 - Occurring Frequency of Smart Cities Elements Total vs Local

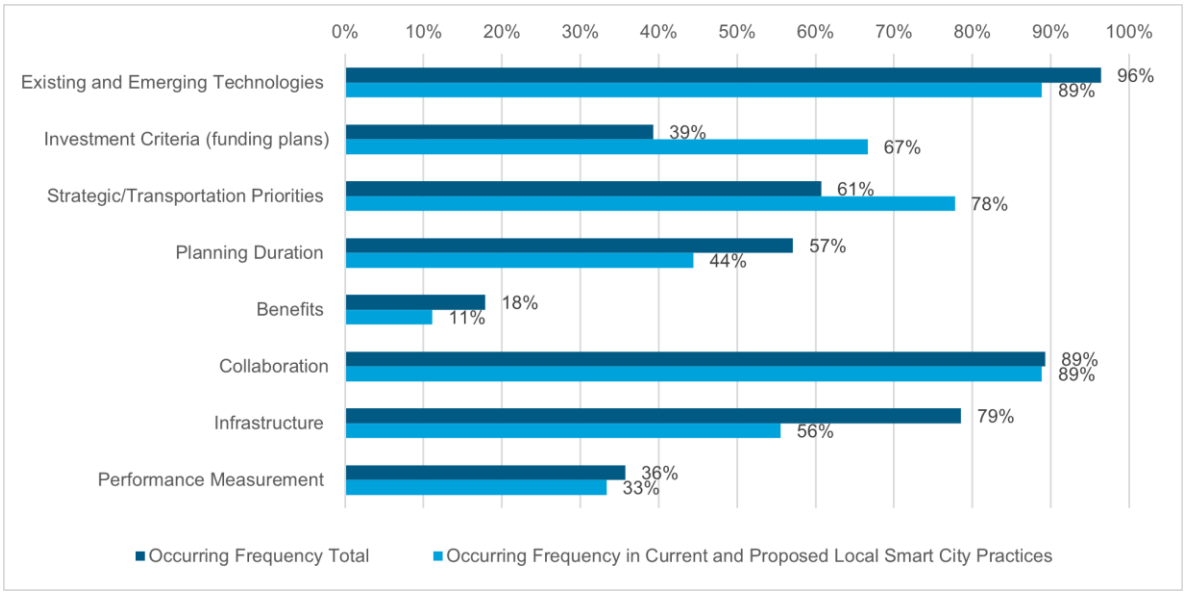
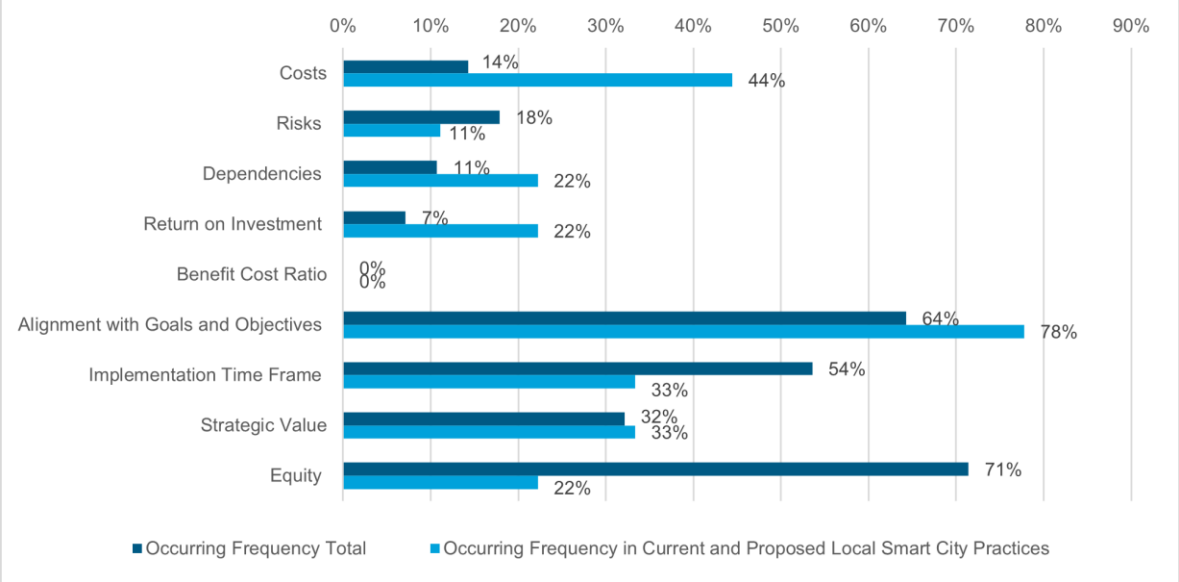


Figure 5-4 - Occurring Frequency of Special Considerations Elements Total vs Local



5.3.2. Discussion of Findings and Gaps Analysis

5.3.2.1. Smart Cities Elements

Analysis demonstrates similar trends between local and global reviewed sources in Smart Cities Elements. Existing and Emerging Technologies and Collaboration are the most frequently addressed elements locally. Performance Measurement, even though not so frequent, but meets the global trends, too.

On the other hand, analysis and reviews also indicate Hillsborough TPO's greater focus on Investment Criteria (funding plans) and Strategic/ Transportation Priorities when compared to global practices. This focus showcases a strong approach in aligning transportation priorities and a thoughtful approach in ensuring the resources are efficiently allocated to maximize the benefits of the funds spent.

Infrastructure, Planning Duration and Benefits have ranked lower in local discussions based on the material made available for the review, however, the high percentage of occurring frequency of these elements in local plans indicates that the TPO recognizes these elements as critical planning elements. The focus on Strategic/ Transportation Priorities also explains that, even though the TPO may not look at Benefits in isolation, they ensure strategies address the regional priorities that will benefit the community. However, as part of the Smart City Mobility Plan, specific benefits to proposed projects will be identified and mapped against the five core investment areas to ensure not only alignment with goals and objectives, but also specific benefits such as Return on Investment are taken into consideration, too.

5.3.2.2. Gaps Analysis

Reviews identified an over 20% gap in addressing Infrastructure needs within local versus global efforts. Both physical and digital infrastructure are critical elements in not only development of a Smart City, but also in the successful delivery of services for the following reasons:

- It is important to benchmark the existing conditions, know where to start and where the gaps are. This has been accomplished through Technology and Toolkit Mapping discussed in Section 6 of this document.
- Both physical and digital infrastructure have equal significance and must be considered in the planning process to ensure efficiency in integration of multiple strategies and solutions.

- Technology is advancing rapidly, therefore, a thoughtful approach in planning for a flexible and well-integrated infrastructure plays a key role in successful deployment of emerging technologies. This will be achieved in Phase 2 of the project through development of the Smart Mobility Plan Roadmap as defined in the recommendations in Section 9 of this report.

5.3.2.3. Special Considerations Elements

As for the Special Considerations Elements, the local focus on Strategic Values is the only element with the similar trends reviewed in global practices. Also, even though Dependencies and Return on Investment scored higher in local sources, they are still among the least addressed considerations overall.

The focus on Alignment with Goals and Objectives and Cost elements demonstrates and accounts for the importance of Investment Criteria and Strategic/ Transportation Priorities and that the prioritization framework is thoughtfully aligned with local Smart Cities Elements.

Benefit Cost Ratio and Strategic Value showcase very similar trends, however, the illustrated difference between other elements can be explained by the regional differences. As previously described, several global trends were reviewed that may not necessarily address or value the same considerations in project prioritization.

5.3.2.4. Gaps Analysis

Considering the global scale of reviewed sources, the difference between local and global trends in prioritization criteria can be validated through recognizing the regional and cultural differences in priorities. In addition, the Special Considerations Elements were developed in alignment with Smart Cities Elements. Therefore, they are customized to Hillsborough TPO regional priorities. Looking at the local practices' findings in isolation, it can be concluded that there is an opportunity to advance considerations on Risks, and to advance discussions on Dependencies, Return on Investment and Equity. As discussed in Section 3.2, Benefit Cost Ratio can be analyzed on an as-needed basis and could be eliminated from the proposed prioritization framework.

In conclusion, Hillsborough TPO is addressing these gaps discussed in this section by adding criteria to the prioritization matrix to explicitly perform quantitative and qualitative analysis of risks, dependencies, ROI, equity considerations, and other gaps described in this section.

6. Technology Toolkit and Mapping

In addition to Smart Cities and Special Considerations Elements, the Discovery Phase approach also reviewed the specific strategies and technologies utilized by both national and global efforts in Smart City planning. The intent was to 1) develop a comprehensive inventory of strategies and technologies categories, 2) identify and develop a comprehensive inventory of available/example solutions under each category and best practices, and 3) map the local efforts against national and global existing and planned technologies.

Reviews and studies identified 14 general categories of Smart Cities strategies and technologies as shown in Table 6-1 - Smart Cities Strategy and Technology Categories.

Table 6-1 - Smart Cities Strategy and Technology Categories

Smart Public Services and Infrastructure	Smart Lighting Solutions	Smart Public Safety	Communications and Connectivity
Stakeholder Partnership	Smart Public Transit	Smart Transportation	Smart Utilities
Smart Energy and Sustainability	Data Management	Information Communication Technology (ICT)	Citizens Engagement
	Smart City Maturity Model Framework/ Performance Measurement	Funding Programs	

Table 6-2 - Technology Mapping provides the comprehensive inventory of available/example technology solutions under each category and performs analysis on 1) the strategies and technologies that the TPO is currently utilizing, 2) strategies and technologies that the TPO is not utilizing, 3) targeted 2045 LRTP core investment areas (color coded), and 4) benefits assessment. Note that the benefits assessments are addressing primary benefits as it relates to the 2045 LRTP five core investment areas.

The table has also been provided in the format of an Excel Spreadsheet as a separate deliverable.

The study also developed fact sheets including specific nationwide examples of strategies, technologies, and initiatives in Appendix C Appendix C. Fact Sheets.

Table 6-2 - Technology Mapping

List of Technologies / Strategies Areas		Technologies/ Strategies Examples (local and national)	Technology/ Strategies we have	Technologies/ Strategies we do not have	New & Emergent Technology/ Strategies	Benefits Assessment
1	Smart Public Service and Infrastructure	Health city initiative		x		6
		Smart screens		x	x	8
		Building management and automation systems		x	x	9
		Smart irrigation systems		x	x	9
		Public restroom occupancy sensors		x	x	5
		Public free internet access		x		10
		Advanced water metering		x	x	7
		Smart bins and benches		x	x	7
		Reimagining Infrastructure	x			10
2	Smart Lighting Solutions	Adaptive lighting		x	x	9
		Environmental detection (such as gunshot)		x	x	8
		LED retrofit		x		10
3	Smart Public Safety	Video sensors		x	x	7
		IoT through spotting danger and managing risks, gunshot sensors, weather sensors		x	x	10
		Drones		x	x	6
		Rapid Transit	x			10
		Improve 911 service		x		10
		Incident situational awareness		x		8
		Data-driven policing practices		x	x	8
		Hazmat awareness and mitigation		x		8
4	Communications and connectivity	5G wireless connectivity		x	x	10
		IoT networks		x	x	10
		Fiber communication		x		10
		Wi-Fi expansion		x		10
		Grow fiber-optic network		x		10
		High speed broadband availability		x	x	10
5	Stakeholder Partnership	Integration of local government's numerous services		x		8
		Connecting government departments through digital strategies		x		8
		Coordinating Committee(s)	x			10
		Transportation management area group(s) and board(s)	x			10
		Regional Smart Cities Priorities		x		10
		Smart cities central goals		x		10
6	Smart Public Transit	Improve access and convenience		x		10
		Mobile ticketing, digital displays with emergency information		x	x	7
		Smart parking meters and apps		x		8
		Sensor-equipped crosswalks		x	x	10
	Smart Transportation	Smart traffic management systems		x	x	10
		Connected and Automated Vehicles	x		x	8
		Connected and Automated Transit	x		x	8
		Traffic Surveillance	x			7
		Real-time Data		x	x	10
		Smart work zone	x		x	10

Table 6-2, Continued

	List of Technologies / Strategies Areas	Technologies/ Strategies Examples (local and national)	Technology/ Strategies we have	Technologies/ Strategies we do not have	New & Emergent Technology/ Strategies	Benefits Assessment
7	Smart Transportation	Smart traffic management systems		x	x	10
		Connected and Automated Vehicles	x		x	8
		Connected and Automated Transit	x		x	8
		Traffic Surveillance	x			7
		Real-time Data		x	x	10
		Smart work zone	x		x	10
		ITS integration and smart system operations		x	x	10
		Transportation systems Interoperability		x	x	8
		Active and arterial traffic management	x			10
		Ride-share programs		x		10
		Micro-Mobility		x	x	6
		Virtual curb-side management		x	x	7
		Emergency vehicles preemption	x			10
		Bike-share programs	x			10
		Traffic incident management	x			10
		Mobility as a Service	x		x	10
		Journey planning		x	x	8
		Travel demand management	x			10
		On-demand transportation programs		x	x	8
		Parking management technologies		x	x	8
		Adaptive/ coordinated Traffic Signal operations	x			10
		Traveler information	x			10
		Multi-modal travel options to improve mobility	x			10
		Vision Zero	x			10
		Integrated asset management		x	x	8
		Transit signal priority		x		8
		Advanced pedestrian and bicycle programs	x			10
		Signal Phase and Timing (SPaT)		x		10
		Data-Driven shared mobility (first/last mile improvements)		x	x	7
		Integrated mobility plan		x	x	10
		Integrated corridor management	x			10
		Event parking management		x		7
		Truck platooning		x	x	6
		Managed lanes		x	x	8
8	Smart Utilities	Real-time monitoring and data exchange		x	x	10
		Grid management and resiliency		x	x	9
		Flood detection		x		10
		Utilities sensors and wireless networks		x	x	8
		Increased visibility and awareness		x		8
9	Smart Energy and Sustainability	Electric vehicles and charging stations		x		10
		Distributed energy resources (rooftop solar panels)		x		10
		Lighting infrastructure (LED retrofits)		x		10
		Regional environmental impact tracking system	x		x	10
		GHG savings		x		10
		Renewable energy strategies		x	x	10
	Data Management	IoT		x	x	10
		Big data		x	x	8
		Predictive analytics		x	x	7

Table 6-2, Continued

List of Technologies / Strategies Areas		Technologies/ Strategies Examples (local and national)	Technology/ Strategies we have	Technologies/ Strategies we do not have	New & Emergent Technology/ Strategies	Benefits Assessment
10		Data generation, distribution, aggregation, analytics and application		x	x	10
		Regional data paltform	x		x	10
		Data privacy		x	x	10
		Open and real-time data platform		x	x	10
		Digital equity		x	x	10
11	Information Communication Technology (ICT)	Partnerships with Tech sectors		x		8
		IoT		x	x	10
		Creating leadership roles for IT		x	x	8
		Identify role of data		x	x	10
		Smart city apps		x	x	10
		Periodic digital master plan		x	x	7
12	Citizens Engagement	Open source apps		x	x	8
		Public outreach	x			10
		Citizen-information access		x		10
13	Performance Management	Smart city maturity model framework		x		10
		System performance tracking	x			10
		Goal(s)-Specific Performance Measures		x		10
		Future focused approach		x		10
14	Funding Programs	Major capital	x			10
		Major investment plans	x			10
		Minor capital		x		7
		Funding priorities	x			10
		ITS Master Plan	x			8
		Short, mid and long-term funding plan	x			10
		Funding Alternatives (Grants, PPP, etc.)		x		8
		Total	28	81	54	

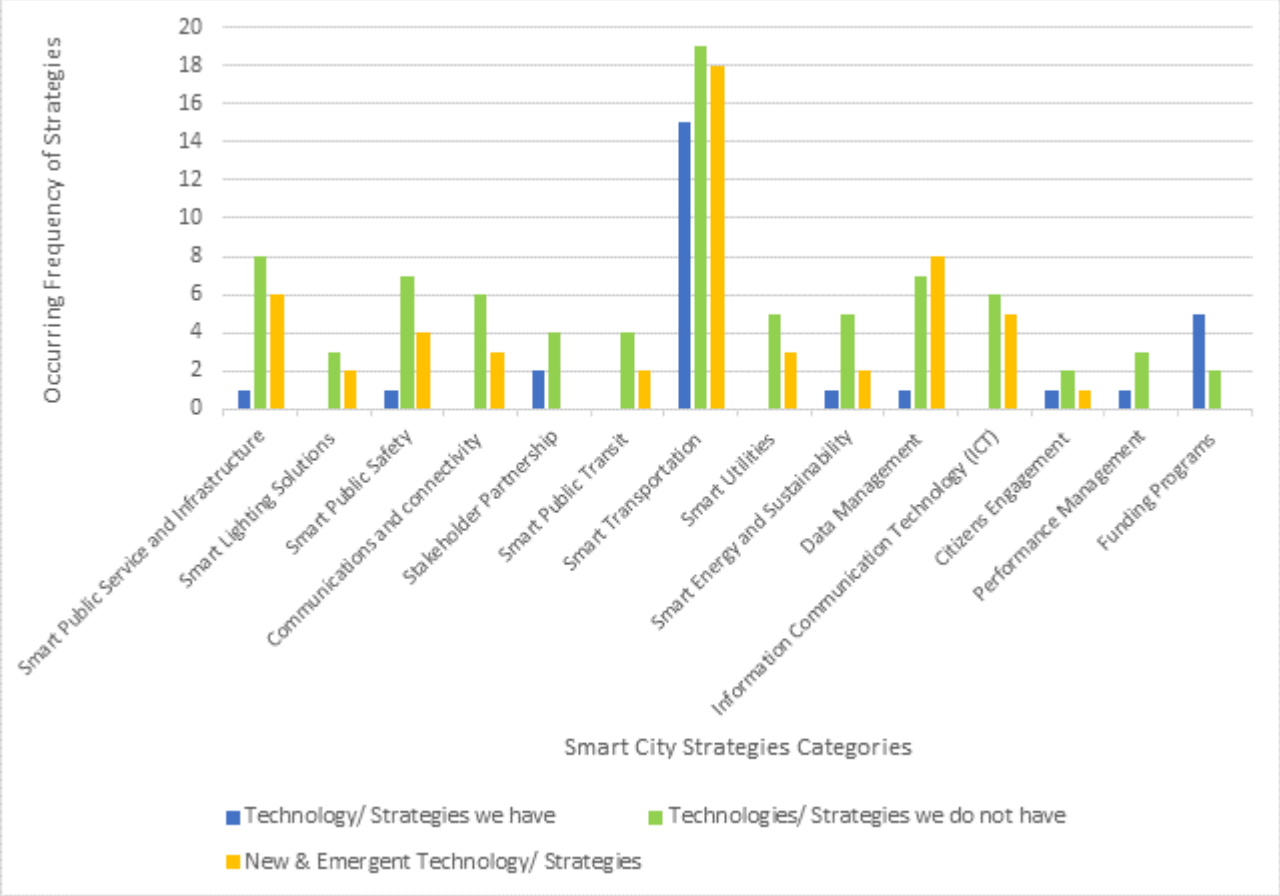
Primary Impacts

Legend
Good repair and resilience
Vision zero
Smart cities
Real choices when not driving
Major investments for economic growth
NA

7. Discovery Phase - Recommendations and Conclusion

Figure 7-1 - Technology Mapping and Assessment Analysis demonstrates a summary of Technology Mapping and Assessment analysis performed following the findings in Section 6.

Figure 7-1 - Technology Mapping and Assessment Analysis



The following are the recommendations for Hillsborough TPO to consider when developing the city's Smart City Mobility Roadmap as a result of the analysis performed as part of the Discovery Phase:

Listed below are the gaps identified within the Technologies/ Strategies areas:

- Smart lighting solutions: solutions that yield to significant benefits through providing sense of safety, security and equity in targeted areas, as well as reduction in energy consumption.
- Communications and connectivity: solutions and strategies that enable deployment of and improve connectivity and communication between smart systems.
- Smart utilities: technologies and strategies that provide real-time data and monitoring of consumption, improve visibility and awareness on the utilities usage and enable performance measurement.
- Information Communication technology (ICT): solutions that provide the IT means to maintain the existing and develop future digital infrastructure required to deliver services to the community.

Listed below are the identified areas of opportunity for the TPO to focus on:

- Smart Public Services and Infrastructure: solutions that address the development of public smart city services and the required infrastructure.

- Smart Public Safety: solutions that offer innovative approaches in identifying danger spots and risk management for safety improvements.
- Smart Public Transit: solutions that assist in ensuring equity and inclusivity, as well as advancing mobility options and choices through transit services.
- Smart Energy and Sustainability: strategies and technologies that help cities save money, improve energy efficiency and delivery, and contributes to regional economic growth.
- Data Management: opportunities to perform accurate performance measurement and make data-driven performance-based decisions, improve regional data sharing, and use reliable methods to govern data.
- Citizens Engagement: solutions that help keep a consistent pace in identifying and addressing residents ' needs within communities.
- Smart City Maturity Model Framework/ Performance Management: frameworks and strategies that help understand and benchmark the current level of maturity in a focus area prior to deployment of technologies.

Listed below are the identified areas of strength based on the analysis of current technologies, strategies and initiatives:

- Stakeholder Partnership: solutions that assist with developing strategic goals, regional priorities, coordinate efforts, and achieve consensus to ensures efficient resource allocation.
- Smart Transportation: solutions that enable economic growth and development, improve quality of life, and encourage sustainability and environmental protection of transportation system.
- Funding Programs: investment plans, programs, and initiatives to identify required and available resources to fund projects.

In conclusion and in identifying the next steps for developing the Smart City Mobility Plan project, it is recommended that the TPO utilize the findings of this review to develop Smart City focus areas, definitions, guiding principles and performance measure that are not only aligned with the 2045 LRTP five core investment areas, but also are aligned with the local and nationwide best practices and initiatives.

It is also recommended that the TPO utilize the Smart City Maturity Model Framework to accurately assess and identify current level of maturity, as well as identifying the desired level of maturity and required action items within a specific timeline.

8. Analysis Phase - Introduction

In support of the Analysis Phase a Prioritization Matrix was developed to enable the review of project ideas that would ultimately drive the production of the regional Smart Mobility Plan Roadmap, the prioritization criteria were developed and agreed with regional partners through a series of one-to-one meetings, the final assessment criteria is provided below in Figure 8-1 - Prioritization Matrix - Assessment Criteria:

Figure 8-1 - Prioritization Matrix - Assessment Criteria

Alignment with 2045 LRTP Goals and Objectives (strategic)				
Good Repair and resilience	**Vision Zero**	**Smart Cities**	**Real choices when not driving**	**Major investments for economic growth**
Preserve Infrastructure/ Sustainability Yes = **1 Point** No = **0 points**	**Safety** Yes = **1 Point** No = **0 Points**	**Innovation and Emerging Technology** Yes = **1 Point** No = **0 Points**	**Mobility and Mode Choice** Yes = **1 Point** No = **0 Points**	**Economic Growth** Yes = **1 Point** No = **0 Points**

Cost	**Implementation Timeframe**	**Equity**	**Dependencies, Business Risks, and Limitations**	**Risk Severity**	**Benefit/Cost Ratio**	**Strategic Value**
$0 - $499,999= **4 Points** $500,000 -$999,999 = **3 Points** $1 M - $2.99 M = **2 Points** $3 M - $5 M = **1 Point** > $5 M = **0 Points**	Short term (0-5 yrs.) = **3 Points** Mid term (5-10 yrs.) = **2 Points** Long term (10+ yrs.) = **1 Point**	High = **3 Points** Medium = **2 Points** Low = **1 Point**	**What is the level of risks and degree of impact?** Examples: legal compliance, operational, stakeholders/public involvement, timing, data sources, technology, etc.	**High = -2 Point** **Moderate = -1 Points** **Low = 0 Points** Based on Dependencies, Business Risk, and Limitations	Low (0-4)= **0 Points** Mid (5-8)= **1 Point** High (9-12)= **2 Points**	Is there a high demand or need for the implementation of this project or will this project improve upon an existing project?? **(0-1 Points)**

As part of the stakeholder engagement activity during the Fall Session of the Tampa Bay Smart City Alliance quarterly workshop a brainstorming exercise was undertaken to identify potential projects or initiatives that should be considered as part of the regional Smart Mobility Plan Roadmap, these were then assessed using the Prioritization Matrix, the results are provided overleaf in Figure 8-2 - Prioritization Matrix - Project Assessment.

The highest-ranking projects we put against the assessment criteria, prioritized those that improved equity and awareness of mobility solutions, digital inclusion and mobility assistance initiative and technology led projects.

Through the Phase 1 of the Smart Mobility plan there has been extensive stakeholder engagement, in addition to those projects at the Fall Session of the Tampa Bay Smart City Alliance quarterly workshop. A further 110 projects or initiatives have been captured; these will be assessed using the Prioritization Matrix as part of Phase 2 of the Smart Mobility plan.

Figure 8-2 - Prioritization Matrix - Project Assessment

Project/Services/Activities	Project Location	(DO NOT FILL IN) The higher the score, the higher return on investment. (Max 18)
Marketing Plans	Promoting travel and transportation initiatives to citizens across the region	17
Digital Inclusion Program	Support adoption of digital tools across the region and improve citizen capabilities in digital adoption	15
Mobility Assistance	Mobility support/ access for vulnerable users to improve equity across the region	15
Car Sharing Platform	Introduction of a car sharing App to support social equity and reduce congestion	14
MaaS Expansion	Expansion of the TBSCA Phase 1 pilot to a regional solution	14
Regional Work Zone Exchange	Introduction of a WZDx regionally as per the USDOT specification	14
Waterborne Transport Plan	New waterborne plan and pilot services	14
Event Parking Management	Smart parking to deal with regional events and reduce congestion	13
Free issue Sensors (SWZ)	In support of 24, free issue of IoT devices to contractors for construction schemes across the region	13
Cyber Security Plans	Development of plans to support enhanced security of transportation assets across the region	13
HART Scheduling Software	Numerous corridors across the HART region	12
AV shuttle expansion	Build on existing pilots and focus on first/ last solution and also social equity opportunities	12
Smart Corridors	Use of technology to ease congestion and improve safety of all users across the region	11
Regional Operating System	Introduction of a system to manage all modes across the region	11
ATCMTD Project	-US 301 from I-4 south to Big Bend RD -Big Bend Rd from US 301 west to US 41 -US 41 north from Big Bend Rd to Pal, River Rd	10
Ramp Metering	Installation of ramp meters at all feasible ramps across the interstate system	10
EV Charging (in residential)	EV charging units in residential communities/ working with HOAs	10
Digital Twins	Development of a digital model of the Tampa Bay transportation system and its assets	10
Red Light Running Cameras	Potentially across Tampa Bay region	9
Digital Signage	New digital wayfinding in major locations/ tourist hotspots	9
Smart Lighting	Potentially across Tampa Bay region	8
HART CAD AVL	Optimize dispatch and location tracking of HART fleet	8
EV Charging	Broader introduction of EV charging across the region	8
Bus Fleet Electrification	Support climate change objectives with an electrified bus fleet across the region	5
HOV Lanes	Addition of HOV on the regional Interstate routes	4

9. Recommendations and Next Steps

9.1. Recommendations

These are the actions that are recommended to the Board:

1. The following Vision Statement is adopted to act as framework to guide planning and development smart cities projects and initiatives.
    - To intelligently deploy the latest Smart City technologies to allow for monitoring, assessment, and management of the transportation network.
    - To translate performance insights into action and provide safe, efficient, convenient, and equitable transportation options across Hillsborough County.
2. Plan for deployment of the highest-ranking projects identified via the Gap Analysis and included in the Table 6-2 - Technology Mapping.
3. Use the Prioritization Matrix to more appropriately score smart city related projects as part of the TIP.
4. Increase funding for the smart cities program in order to enable delivery of the 5 goals (e.g., Digital Inclusion).
5. Utilize the Smart City Fact sheets (by all partner agencies) to engage and inform the general public.

9.2. Next Steps

After the completion of Phase 1 of the Smart Mobility Plan, the plan will move into the next steps, which are outlined below:

1. State of the Practice: building on the findings in phase 1, we will develop a State of the Practice to study other local and global Smart Mobility Plan components.
2. Smart Mobility Plan Capability Maturity Model (CMM) Workshop: facilitate workshops to identify and benchmark the current level of maturity in Smart Mobility strategies. Drawing from the FHWA CMM framework and prior to the workshops, we will work with Hillsborough TPO to identify the dimensions to be assessed. We will then develop survey questionnaires under each dimension and undertake workshops to identify current level of Smart Mobility maturity and perform gap analysis.
3. Development of Smart Mobility Plan Vision, Mission, Goals, and Objectives (Smart Mobility Elements): based on the findings from the CMM workshop, we will facilitate meetings and workshops to share findings and identify Hillsborough Smart Mobility Plan goals and objectives accordingly. This will be performed in alignment with existing goals and objectives to demonstrate how the new goals and objectives are complementing the existing ones.
4. Implementation Plan (Roadmap): under each CMM category and in alignment with identified goals and objectives, we will develop a set of action items with associated time frames. Action items may include multiple activities such as development of new processes and procedures, plans and programs, partnerships, new policies, list of technologies, etc. based on the stakeholders' feedback and in order to bridge the gap between existing conditions and the Plan's vision. As part of this task, we will also develop steps to be undertaken in order to improve capabilities under each CMM dimension.
5. Performance Measurement: to enable a data-driven and performance-based approach in managing and implementing Smart Mobility projects, we will develop a performance measurement framework to assist Hillsborough TPO identify targeted areas and prioritize projects accordingly. In this process, we will also leverage the prioritization matrix that was established as part of Phase 1.
6. Final Plan: development of the Hillsborough Smart Mobility Plan document, including the findings from steps 1 to 5.

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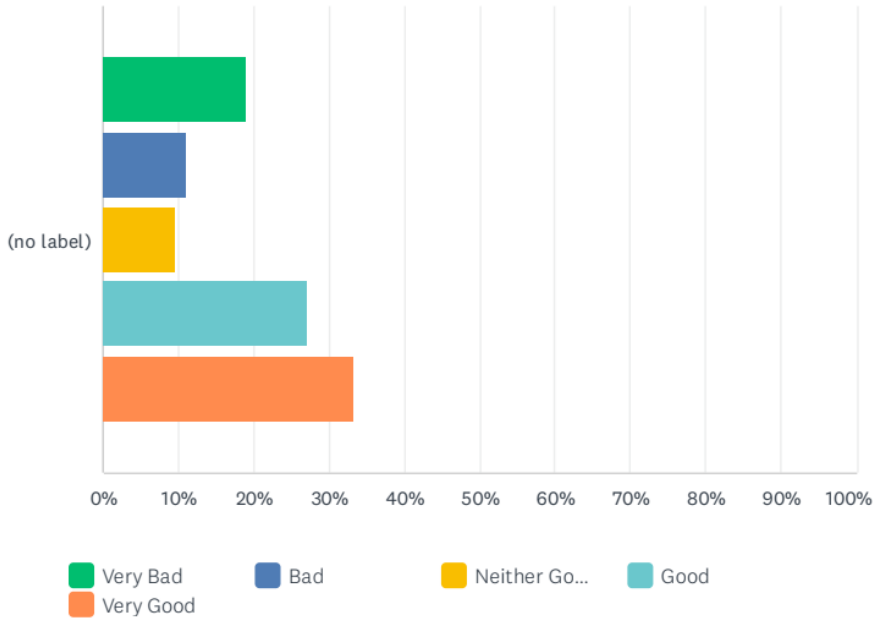
Appendix A. On-Line Survey

Q1 How would you feel about having Red Light Running Cameras in your neighborhood?

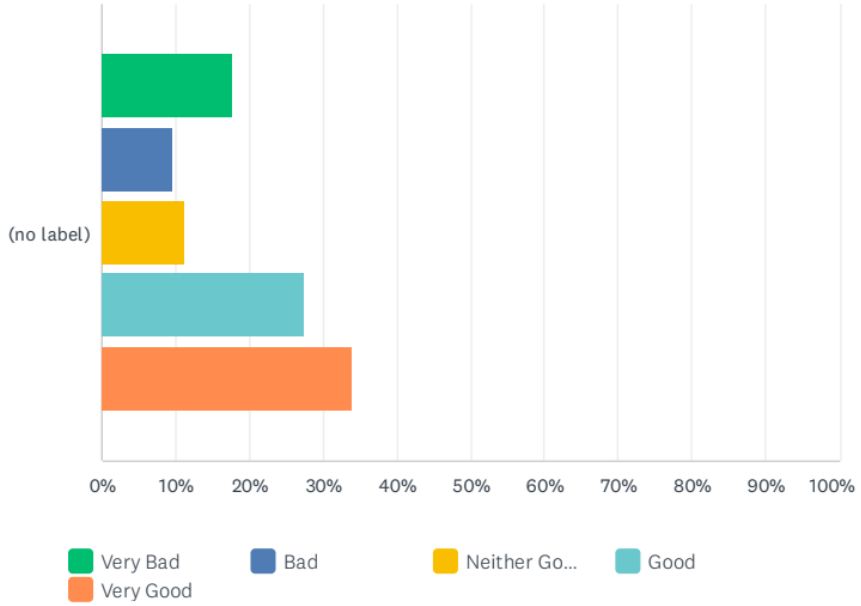
Answered: 63 Skipped: 0



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	19.05% 12	11.11% 7	9.52% 6	26.98% 17	33.33% 21	63	3.44

Q2 How would you feel about Red Light Running Cameras being in someone else's neighborhood?

Answered: 62 Skipped: 1



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	17.74% 11	9.68% 6	11.29% 7	27.42% 17	33.87% 21	62	3.50

Q3 What interests or excites you about Red Light Running Cameras?

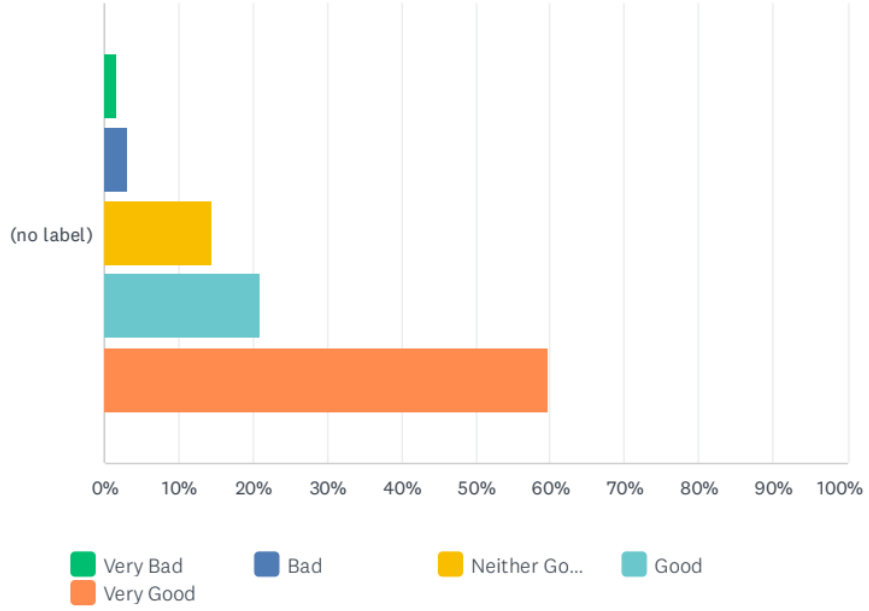
Answered: 53 Skipped: 10

Q4 What worries or concerns you about Red Light Running Cameras?

Answered: 53 Skipped: 10

Q5 How do you feel about having Flood Sensors in your neighborhood?

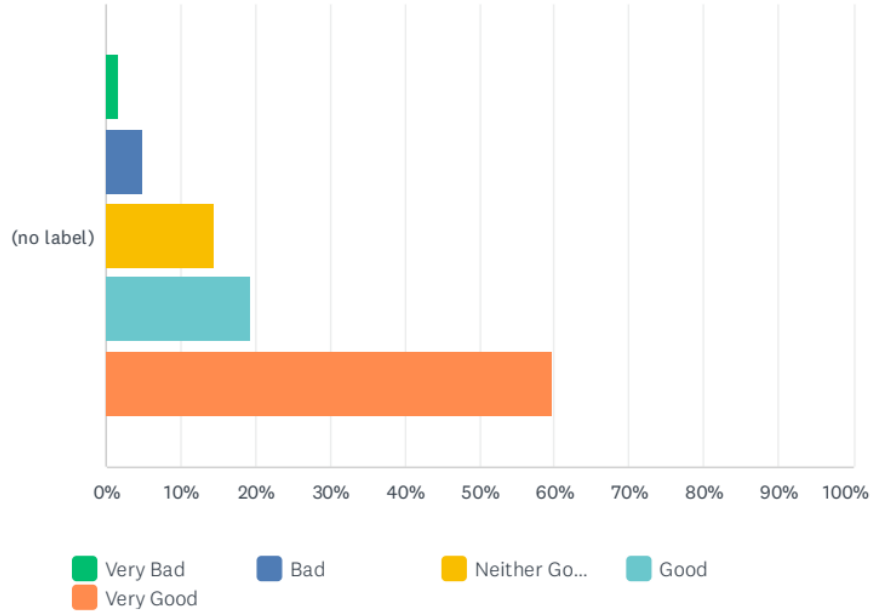
Answered: 62 Skipped: 1



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	1.61% 1	3.23% 2	14.52% 9	20.97% 13	59.68% 37	62	4.34

Q6 How do you feel about Flood Sensors being in someone else's neighborhood?

Answered: 62 Skipped: 1



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	1.61% 1	4.84% 3	14.52% 9	19.35% 12	59.68% 37	62	4.31

Q7 What interests or excites you about Flood Sensors?

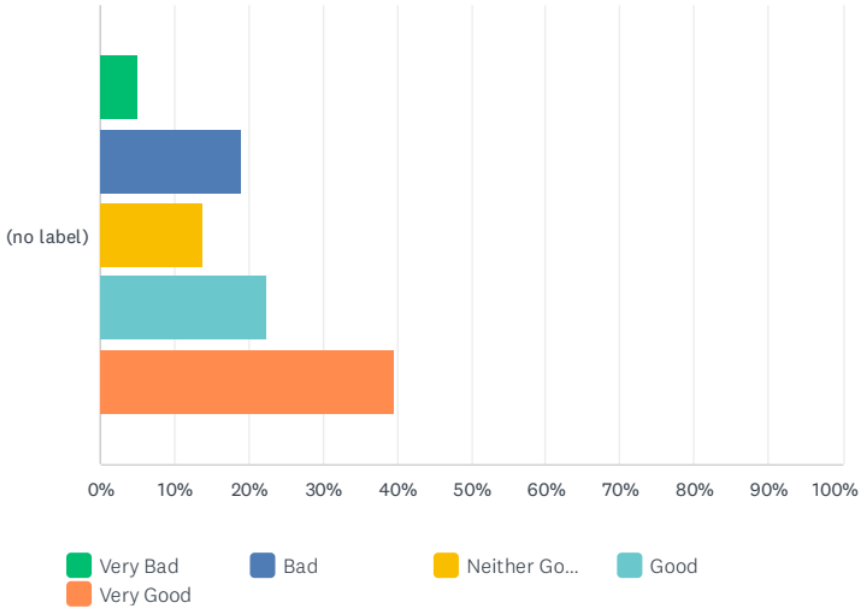
Answered: 49 Skipped: 14

Q8 What worries or concerns you about Flood Sensors?

Answered: 48 Skipped: 15

Q9 How would you feel about having Smart Street Lights in your neighborhood?

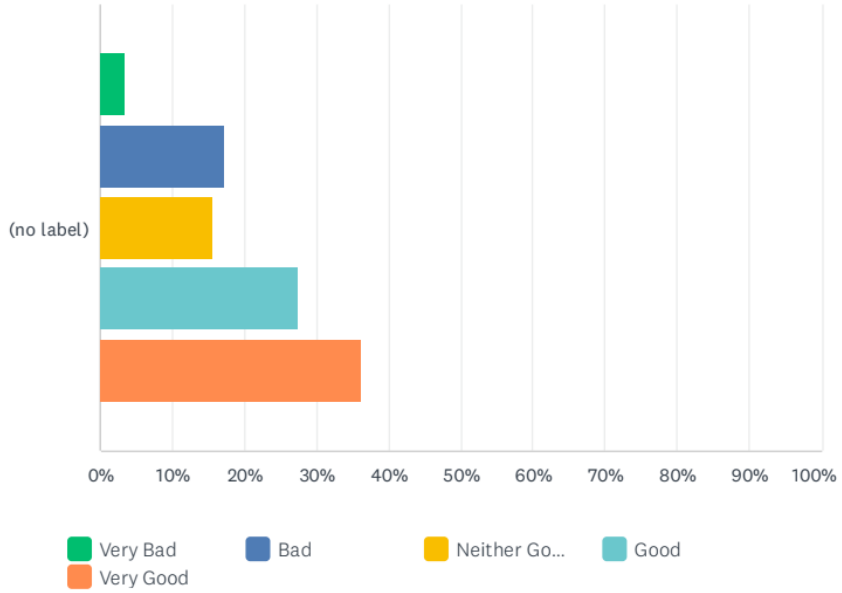
Answered: 58 Skipped: 5



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	5.17% 3	18.97% 11	13.79% 8	22.41% 13	39.66% 23	58	3.72

Q10 How would you feel about Smart Street Lights being in someone else's neighborhood?

Answered: 58 Skipped: 5



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	3.45% 2	17.24% 10	15.52% 9	27.59% 16	36.21% 21	58	3.76

Q11 What interests or excites you about Smart Street Lights?

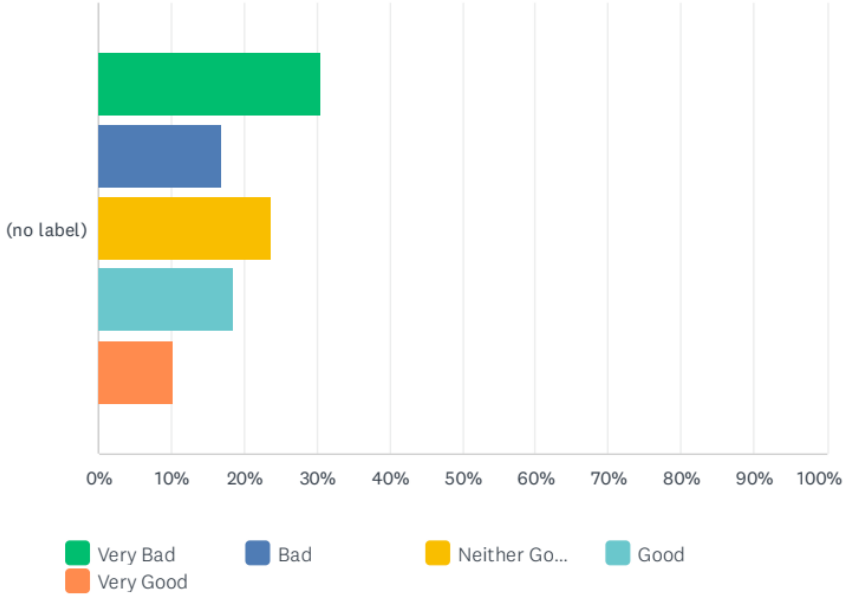
Answered: 47 Skipped: 16

Q12 What worries or concerns you about Smart Street Lights?

Answered: 52 Skipped: 11

Q13 How do you feel about Facial Recognition Software?

Answered: 59 Skipped: 4



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	30.51% 18	16.95% 10	23.73% 14	18.64% 11	10.17% 6	59	2.61

Q14 What interests or excites you about Facial Recognition Software?

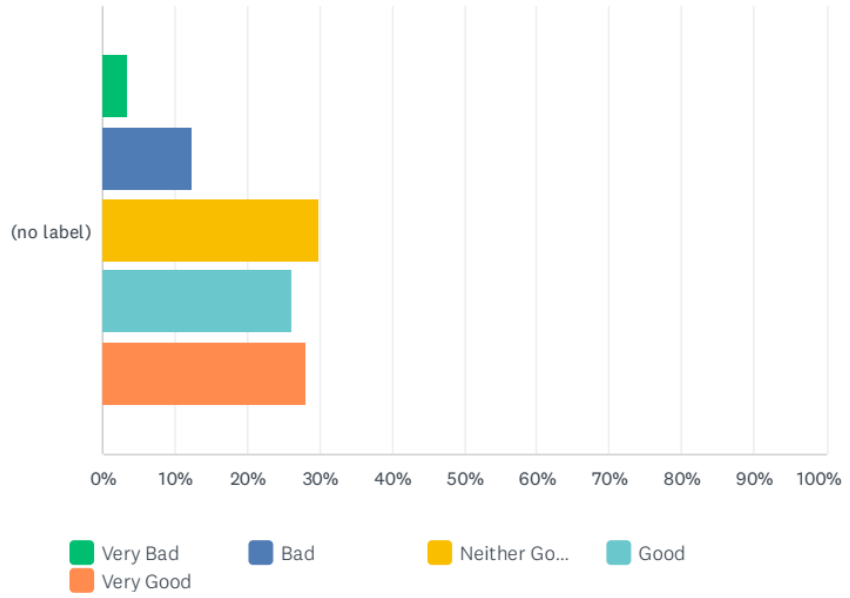
Answered: 48 Skipped: 15

Q15 What worries or concerns you about Facial Recognition Software?

Answered: 50 Skipped: 13

Q16 How would you feel about having Gunshot Detection Sensors in your neighborhood?

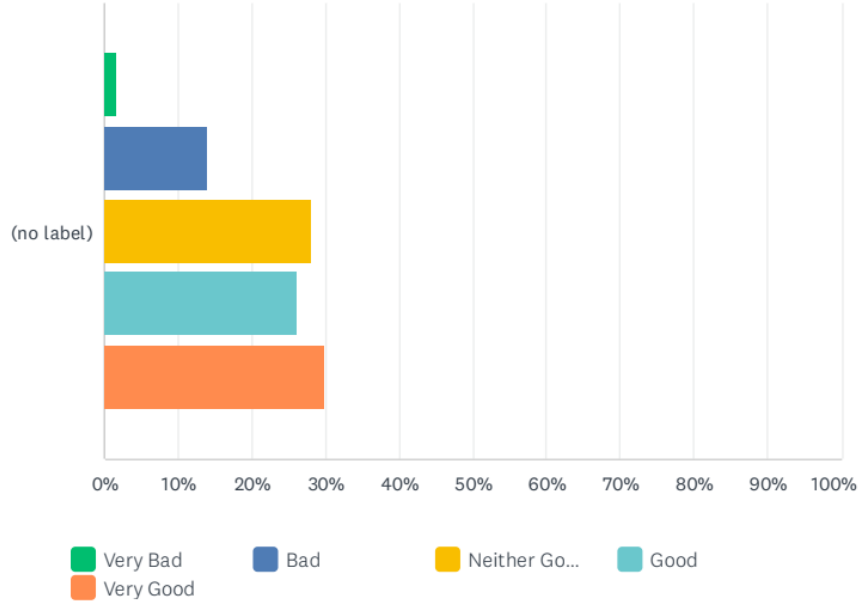
Answered: 57 Skipped: 6



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	3.51% 2	12.28% 7	29.82% 17	26.32% 15	28.07% 16	57	3.63

Q17 How would you feel about Gunshot Detection Sensors being in someone else's neighborhood?

Answered: 57 Skipped: 6



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	1.75% 1	14.04% 8	28.07% 16	26.32% 15	29.82% 17	57	3.68

Q18 What interests or excites you about Gunshot Detection Sensors?

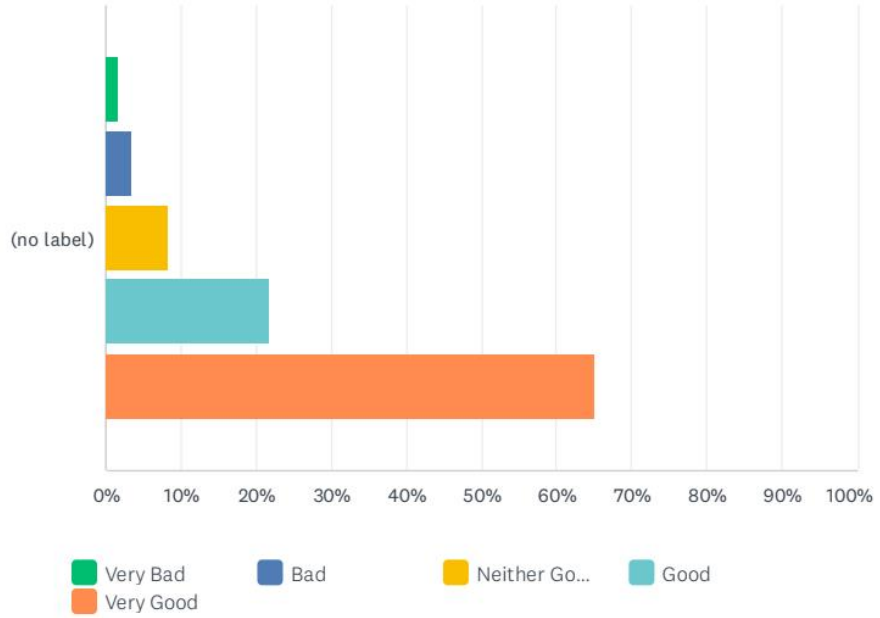
Answered: 47 Skipped: 16

Q19 What worries or concerns you about Gunshot Detection Sensors?

Answered: 47 Skipped: 16

Q20 How would you feel about having a Smarter Public Transit System?

Answered: 60 Skipped: 3



	VERY BAD	BAD	NEITHER GOOD NOR BAD	GOOD	VERY GOOD	TOTAL	WEIGHTED AVERAGE
(no label)	1.67% 1	3.33% 2	8.33% 5	21.67% 13	65.00% 39	60	4.45

Q21 What interests or excites you about a Smarter Public Transit System?

Answered: 50 Skipped: 13

Q22 What worries or concerns you about a Smarter Public Transit System?

Answered: 49 Skipped: 14

Q23 Please enter your contact information below to receive more information about our Smart Cities Master Plan.

Answered: 32 Skipped: 31

ANSWER CHOICES	RESPONSES	
Name	100.00%	32
Company	0.00%	0
Address	84.38%	27
Address 2	0.00%	0
City/Town	93.75%	30
State/Province	90.63%	29
ZIP/Postal Code	87.50%	28
Country	0.00%	0
Email Address	93.75%	30
Phone Number	59.38%	19

Appendix B. Letters of Support

SMART MOBILITY PLAN – LETTER OF SUPPORT

Reply | Reply All | Forward | ...

SK

Spitz, Kenneth <Kenneth.Spitz@dot.state.fl.us>
To Johnny Wong
Cc Woodcock, Lee

Fri 05/11/2021 12:11

You replied to this message on 05/11/2021 12:14.

Johnny,

Further to our meeting on the Smart Mobility Plan, I wanted to follow up and provide a letter of support.

A regional plan of this nature is critical to improving transportation, safety and mobility. The Smart Mobility Plan has been developed in line with the principles of the Tampa Bay Smart Cities Alliance and the vision of the Mobility Innovation and Technology Team. The prioritization matrix developed as part of this effort is an innovative and beneficial approach – that other agencies should study.

I appreciate your collaboration and look forward to working with you on the next steps.

Kenneth Spitz, AICP
Transportation Planning Manager / FDOT D7
Complete Streets / District Coordinator
MITT – Mobility Innovation & Technology Team / District Leader
Lane Repurposing Review Committee / Member
Tampa Bay Smart Cities Alliance / Tri-Chair

Direct: (813) 975-6480

City of Tampa
Jane Castor, Mayor

Mobility Department
Smart Mobility Division
1104 E. Twiggs Street, Suite 200
Tampa FL 33602
Office (813) 274-7358

October 29, 2021

SMART MOBILITY PLAN – LETTER OF SUPPORT

Dear Dr. Wong,

Thank you for the recent meeting briefing me and my colleagues on Hillsborough TPO's Smart Mobility Plan.

We are supportive of the strategic approach you have taken in developing the plan. The horizon scanning to help inform the prioritization matrix criteria is relevant to work we do here in the City of Tampa as we plan future projects related to Smart Cities technologies. We welcome the opportunity to apply the matrix to our own efforts.

In addition, we appreciate the efforts you and the team have gone to in outreach both to the community and to partner agencies. The briefings at the Tampa Bay Smart Cities Alliance and ITS Committee as well as the peer-to-peer meetings have been useful as we learn and contribute to the development of the plan.

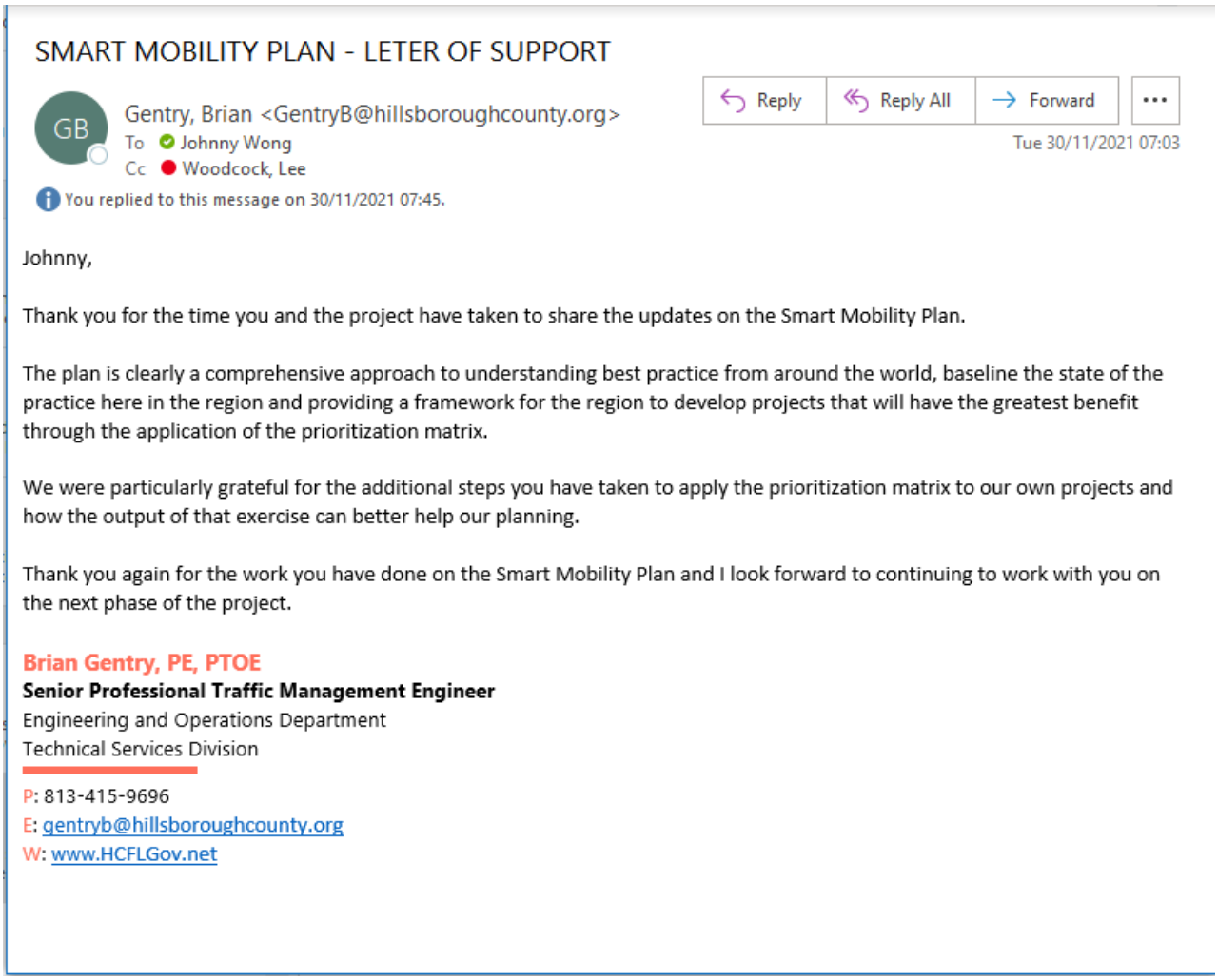
We fully support the plan and look forward to collaborating on the next phase and bringing the roadmap to life for the benefit of the region and the travelling public.

Sincerely,

Brandon Campbell

Brandon Campbell

Smart Mobility Manager



SMART MOBILITY PLAN - LETER OF SUPPORT

GB

Gentry, Brian <GentryB@hillsboroughcounty.org>
To Johnny Wong
Cc Woodcock, Lee

Reply | Reply All | Forward | ...

Tue 30/11/2021 07:03

You replied to this message on 30/11/2021 07:45.

Johnny,

Thank you for the time you and the project have taken to share the updates on the Smart Mobility Plan.

The plan is clearly a comprehensive approach to understanding best practice from around the world, baseline the state of the practice here in the region and providing a framework for the region to develop projects that will have the greatest benefit through the application of the prioritization matrix.

We were particularly grateful for the additional steps you have taken to apply the prioritization matrix to our own projects and how the output of that exercise can better help our planning.

Thank you again for the work you have done on the Smart Mobility Plan and I look forward to continuing to work with you on the next phase of the project.

Brian Gentry, PE, PTOE
Senior Professional Traffic Management Engineer
Engineering and Operations Department
Technical Services Division

P: 813-415-9696
E: gentryb@hillsboroughcounty.org
W: www.HCFLGov.net

From: Dexter Corbin <CorbinD@gohart.org>
Sent: Friday, February 11, 2022 1:45 PM
To: Johnny Wong <wongj@plancom.org>
Cc: Richard Kinning <KinningR@gohart.org>; Woodcock, Lee <lee.woodcock@atkinsglobal.com>
Subject: Smart Mobility Plan - Letter of Support

Johnny

I wanted to follow up on our recent meeting (January 21st, 2022) and thank you for taking the time out to brief myself and colleagues on the Smart Mobility Plan.

we appreciate the efforts you and the team have gone to in outreach both to the community and to partner agencies, the briefings at the Tampa Bay Smart Cities Alliance, ITS Committee as well as the peer-to-peer meetings have been incredibly useful to learn and contribute to the development of the plan.

We fully support the plan and look forward to collaborating on the next phase and bringing the roadmap to life for the benefit of the region and the travelling public.

Thanks,
Dexter Corbin

Dexter Corbin
Director of Technology and Innovation
Hillsborough Transit Authority (HART)
1201 East 7th Avenue
Tampa, FL 33605
Direct: (813) 384-6299
Cell: (813) 442-9893
CorbinD@gohart.org

January 4, 2022

Johnny Wong, PhD
Principal Planner
Hillsborough County, Transportation Planning Organization
601 E. Kennedy, 18th Floor
Tampa, Florida 33601-1110

RE: Smart Mobility Plan – Letter of Support

Dear Dr. Wong:

On behalf of the Tampa-Hillsborough Expressway Authority, please accept this letter as an expression of our support for the Hillsborough County Transportation Planning Organization's "Smart Cities Mobility Plan."

Projects such as the Smart Cities Mobility Plan provide an opportunity for municipalities to take the next steps to implement advanced transportation technology in pursuit of an enhanced quality of life for its citizens. Using the Smart Cities Mobility Plan to outline prioritized projects can provide the means and direction to implement technology solutions sooner. In addition, we consider the work you have done on the horizon scanning, project identification and developing criteria for the assessment of projects in the prioritization matrix will be incredibly valuable for the region.

We appreciate your outreach and engagement with us, and we look forward to contributing to the next steps and continued regional collaboration.

Sincerely,

Anna Quiñones
Planning Project Manager
Tampa Hillsborough Expressway Authority

TAMPA-HILLSBOROUGH COUNTY EXPRESSWAY AUTHORITY
1104 EAST TWIGGS STREET SUITE 300
TAMPA, FL 33602
PH: 813.272.6740 FAX: 813.273.3730
WWW.TAMPA-XWAY.COM

CITY OF
TEMPLE TERRACE
Amazing City. Since 1925.

19 January 2022

Johnny Wong, PhD
Principal Planner
Hillsborough County Transportation Planning Organization
601 E. Kennedy Blvd
Tampa, FL 33602

Re: Smart Cities Mobility Plan – Letter of Support

Dear Dr. Wong,

It's great to see the Hillsborough County Transportation Planning Organization (TPO) create a Smart Cities Mobility Plan. The vision and road map you develop will aid the region in embracing more technology. Furthermore, we appreciated the opportunity to provide the TPO with a list of smart technology projects the City is interested in as you develop a regional plan.

That said, the City of Temple Terrace fully supports the Smart Cities Mobility Plan and looks forward to working with the TPO on the next phase.

Sincerely,

Brian McCarthy, P.E.
City Engineer

Public Works Utilities Department
11250 NORTH 53rd STREET • TEMPLE TERRACE, FLORIDA 33617
PHONE 813.506.6587 • FAX 813.506.6411 • www.templeterrace.com

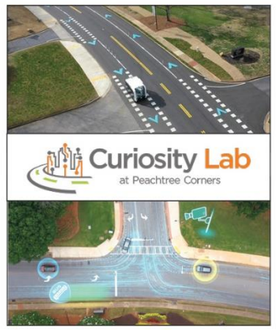
Appendix C. Fact Sheets

Smart Transportation - Integrated Corridor Management

Integrated corridor management (ICM) is a strategy to maximize supply of underutilized capacity on roadways by managing movement of cyclists, pedestrians, cars, transit, freight and others all together. This marks a stark contrast to the traditional approach of considering each user separately. By integrating and treating all existing structures and systems as one operation, improvements can be made for all users and balanced appropriately according to need. The result of these massive integration efforts is to have both target corridors and parallel roads resemble living laboratories, in which traffic engineers are constantly monitoring and studying the behaviors of users and adapting the system to meet their needs.

NATIONWIDE EXAMPLES SOLUTIONS:

Curiosity Lab, Peachtree Corners, GA



- **Background:** Some cities are utilizing the pilot approach in testing and developing proof of concepts for smart transportation strategies and technologies. Peachtree Corners identified a test site for transportation technologies so that they could test the technologies' capabilities in a safe and cost-effective manner within a controlled environment. This will help the transformation of these technologies from concept to commercialized and scalable projects.
- **Strategy:** Peachtree Corners city developed Curiosity lab; a living laboratory that is designed to be utilized as the proving ground for transportation technologies. The 500-acre technology park consists of 5G-enabled 1.5 autonomous vehicle test track and smart cities, enabling daily interaction between road users and the test tracks on a daily basis. The lab's intelligent traffic cameras, traffic signals, smart streetlights, and data sensors provide video coverage and collect data that is monitored from a central operations center. It also features technology incubators that provides an innovation space dedicated to early-stage startups and corporate innovators within the industry. Sprint has partnered with the city and provides subject matter experts at no charge to the organization interested in exploring 5G.
- **Key Outcomes:**
  - Safe and controlled environment for emerging technology pilot projects to help identify interoperability, capabilities and potential challenges, therefore enables experience-based and informed decision-making
  - Enhanced collaboration between partner agencies and the private industry
  - Expedites the emerging technology testing and deployment through real-world experiments and fine-tuning

TARGETED SMART CITIES ELEMENTS AREAS

Existing and Emerging Technologies | Investment Criteria | Strategic/Transportation Priorities | Planning Duration | Benefits | Collaboration | Infrastructure | Performance Measurement

TARGETED HILLSBOROUGH CORE INVESTMENT AREAS

Good Repair and Resilience | Vision Zero | Smart Cities | Real Choices When Not Driving | Major Investments for Economic Growth

Sources:
https://www.curiositylabptc.com/
https://www.cinemassive.com/case-studies-list/the-curiosity-lab-at-peachtree-corners/

CDOT and Panasonic V2X Roadway Management

- **Background:** Colorado Department of Transportation (CDOT) seeks ways to collect and utilize data to perform efficient, informed and cost-effective roadway management within the state and deployed connected vehicles for a real-world experiment.
- **Strategy:** In collaboration with Panasonic Corporation of North America, CDOT and building on a successful pilot program, the DOT performed real-world deployment of an advanced Vehicle-to-Everything (V2X) on I-70. Along the corridor and during the pilot, road-side nits and connected vehicles collected and shared data and sent information to the CDOT-Panasonic V2X Data Processing Center through cellular network. The center utilized the data and together with weather-related data performed analysis and transmitted information back to the vehicles. The objective was to improve safety, mobility and operations on the roadway, and support local traffic managers with informed-decision making.
- **Key Outcomes:**
  - Largest V2X pilot in North America
  - Enhanced collaboration and partnerships
  - Enabled additional pilot projects for V2X technology
  - Encouraged collaboration with automobile manufacturing companies
  - Up to 80% fewer crashes and 50% shorter travel times, improved air quality, enhanced economic growth

TARGETED SMART CITIES ELEMENTS AREAS

Existing and Emerging Technologies | Investment Criteria | Strategic/Transportation Priorities | Planning Duration | Benefits | Collaboration | Infrastructure | Performance Measurement

TARGETED HILLSBOROUGH CORE INVESTMENT AREAS

Good Repair and Resilience | Vision Zero | Smart Cities | Real Choices When Not Driving | Major Investments for Economic Growth

Sources:
https://www.codot.gov/news/2018/july/cdot-and-panasonic-take-first-steps-to-turn-i-70-into-connected-roadway

Smart Corridors

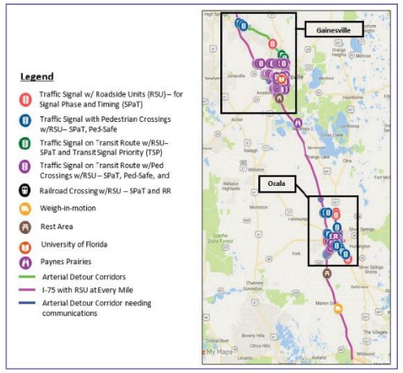
Smart corridors are a technology-driven approach to the use of roadways both freeways and arterials. They increase capacity and improve journey time reliability while maintaining safety. The technology is controlled from regional control centers which can, for example, activate and change signs and variable speed limits. This helps keep the traffic flowing more smoothly.

On some busier sections of corridors, for example, the hard shoulder is temporarily opened or have converted to a permanent extra lane so that more vehicles can travel, avoiding the expense and disruption of widening the road.

NATIONWIDE EXAMPLE SOLUTIONS:

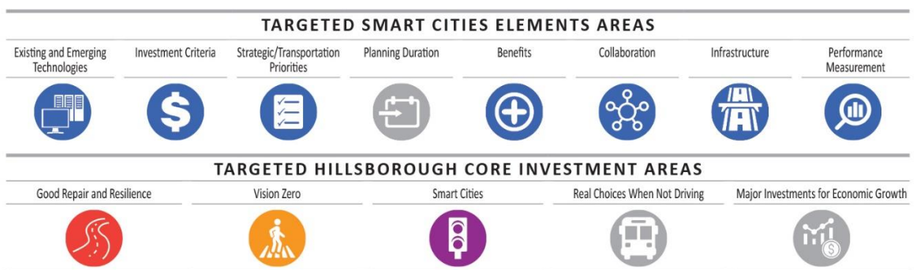
I-75 Florida's Regional Advanced Mobility Elements (FRAME) project

- **Background:** I-75 Florida's Regional Advanced Mobility Elements (FRAME) project deployed emerging technologies to better manage, operate, and maintain the multi-modal transportation system and create an Integrated Corridor Management solution on I-75 and state highway systems in the Cities of Gainesville and Ocala.
- **Strategy:** The emerging technologies in this project are Automated Traffic Signal Performance Measures and Connected Vehicle technologies such as Roadside Units and On Board Units for effective traffic operations; Transit Signal Priority and Freight Signal Priority. The goal of the project is to disseminate real-time information to the motorists during freeway incidents
- **Key Outcomes:**
  - Increased safety for I-75 users
  - Improved reliability for I-75 users
  - Reduced delay for trips using I-75
  - Accommodate population and economic growth and demand for moving people and freight
  - Enhanced regional emergency evacuation and response

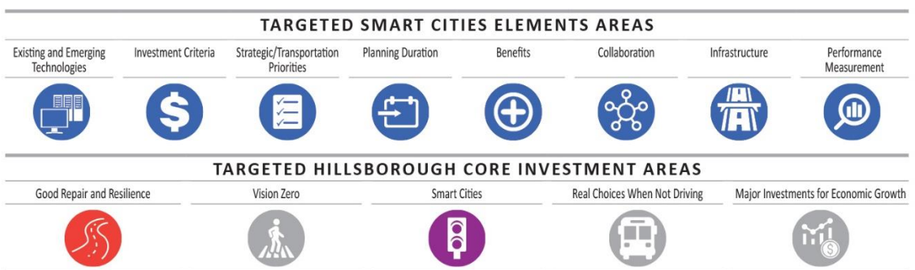


North Avenue, Atlanta, GA

- **Background:** North Avenue Smart Corridor project used the latest technology to increase safety and improve multimodal traffic operations in this 2.3-mile stretch of roadway. In a partnership with the Georgia Institute of Technology and the Georgia Department of Transportation, data is gathered and analyzed to assist both short- and long-term transportation planning to create a safer and more efficient place to live, work, and play. North Avenue connects some of Atlanta's most important destinations such as Coca-Cola headquarters, AT&T headquarters, GDOT, etc.
- **Strategy:** A public demonstration and "living lab" for Internet of Things (IoT) deployment, data collection/analytics, autonomous vehicles, and partnerships, the innovative living lab approach delivered a range of technologies including:
  - Installation and use of hundreds of internet of things (IoT) sensors
  - Urban environment adaptive signal timing system
  - Vehicle-to-infrastructure communications
  - Bluetooth travel time and origin destination system
  - Demonstrating connected automated vehicles
  - Reconfiguration of existing roadway through restriping to support crash reduction
- **Key Outcomes:**
  - Smoother traffic flow, more reliable journey times
  - Improved safety for all road users
  - Collaborative working between the public and private sector
  - Highlights Georgia's and Atlanta's belief in the effectiveness of Smart City technologies



Sources:
FDOT, https://www.fdot.gov/traffic/its/projects-deploy/cv/maplocations/i75-frame.shtm



Sources:
Atkins
https://www.snclavalin.com/en/beyond-engineering/north-avenue-smart-corridor

Smart Corridors (continued)

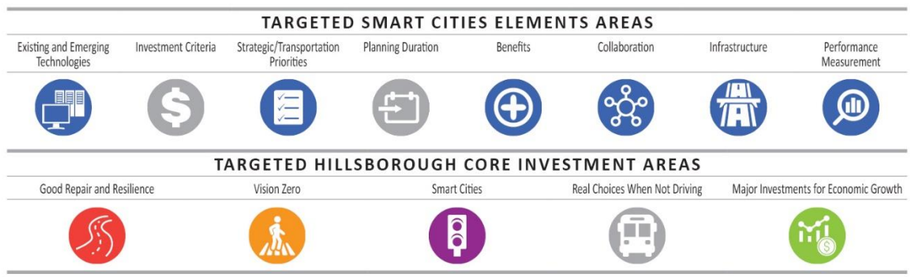
NATIONWIDE EXAMPLE SOLUTIONS:

The Ray, Atlanta, GA

- **Background:** In collaboration with amazing partners The Ray brings these big potential technologies and best practices to their stretch of I-85. Located along The Ray, the Georgia Visitor Information Center in West Point is home to the state's very first solar-powered PV4EV (photovoltaic for electric vehicle) charging station. It's one giant step toward creating the infrastructure that's needed to support electric vehicle transportation. First-in-the-world roll-over WheelRight tire safety monitoring system sends drivers a text message with critical information about their individual tire pressure and tread depths. The Ray is the testing ground for Wattway's pilot project in the U.S.: a pavement that uses traditional solar cells, protected in a patented frame, that allows the road surface to generate clean energy under heavy vehicles. The Georgia Department of Transportation (GDOT) and The Ray are jointly partnering with Panasonic to create a vehicle-to-everything (V2X) data ecosystem that will enable Georgia's first connected interstate roadway. In addition to several roadside units along The Ray that will receive connected vehicle information, Panasonic is building their CIRRUS V2X (vehicle-to-everything) platform, or the "brain", enabling Georgia DOT to leverage the real-time, location-specific data to improve roadway safety, ease congestion, identify maintenance needs and roadway interruptions.
- **Strategy:** Georgia is implementing new ideas and technologies to create a regenerative highway ecosystem on The Ray's 18-mile stretch of I-85, and several pilot projects are already underway, including solar-powered vehicle charging, tire safety check station, solar-paved highway, smart planting, bioswales, climate modeling, V2X connected technology, etc.
- **Key Outcomes:**
  - USA's first road surface solar panels on autonomous vehicle lane
  - Co-locating transportation, energy and information technologies
  - Regional collaboration and partnerships with tech companies, stakeholders and research centers

Truck Highway 55 Connected Corridor, Mn

- **Background:** MnDOT plans to deploy SPaT at approximately 22 traffic signals along corridors between I-494 and I-94. Two deployment locations have been elected, TH-55 and I-394, each offering a different scenario for application of the Snow Plow Signal Priority (SPSP). Along TH-55, signal priority would be given to plows as they approach mainline signals. Deployment on I-394 would occur at interchange signals and ramp meters along the corridor, allowing plows clearing exit and entrance ramps to operate more efficiently.
- **Strategy:** In response to the Connected Vehicle SPaT Deployment Challenge, MnDOT has been working with public and private stakeholders to explore key areas of interest for CV. The highest priority was identified as snow plow and maintenance operations. The SPSP system would provide plows the ability to request extended green or early green phases at traffic signals along snow plow routes via DSRC.
- **Key Outcomes:**
  - Increase safety and mobility of roadways
  - Improve plowing times and fuel efficiency by reducing time spent waiting at signals
  - Improve productivity/efficiency of gang plowing operations
  - Establish MN as an active participant in CV technology
  - Gain valuable procurement, licensing, installation, and operational experience with CV technology
  - Identify priority considerations for AV/CV legislation and rulemaking



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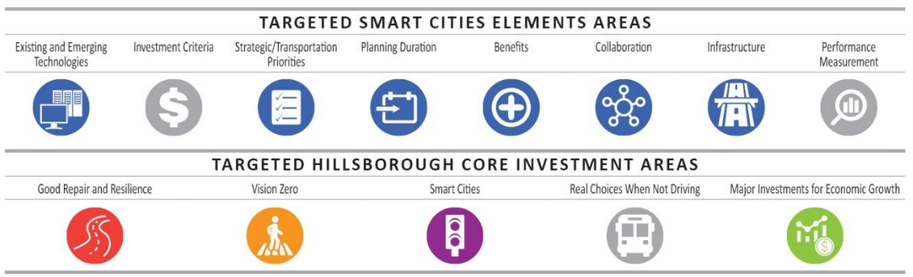

Sources:
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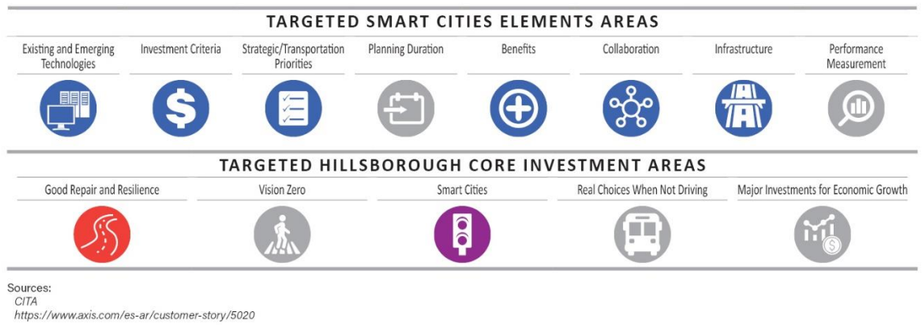
Smart Public Services and Infrastructure

Smart public services and infrastructure address the development of public smart city services and the required infrastructure to enable the solutions' deployment. As technology is transforming lives, enabling automation and seamless connectivity, and unlocking potentials of emerging technologies to revolutionize public services. Developing the appropriate infrastructure that can support and advance the public service technologies is critical to the success of these efforts.

NATIONWIDE EXAMPLE SOLUTIONS:

Smart Waste Management, New Orleans, LA

- **Background:** Despite the successful efforts in collecting refuse in residential, commercial and tourism areas, the New Orleans sanitation department faced challenges in collecting trash, especially with illegal disposal.
- **Strategy:** The sanitation department utilized HDTV-resolution cameras integrated with radar sensors and installed at locations identified as chronic illegal dumping sites. As part of the mayor's CleanUpNOLA initiative, the radar system identifies illegal dumping activities, tracks the vehicle or the person automatically, and triggers an alarm to notify the responsible party. In addition, and when the cameras are not actively monitoring sanitation crime, they operate as regular safety cameras.
- **Key Outcomes:**
  - Crime detection and collection of fines from illegal dumping
  - Ability to increase the return on investment by utilizing cameras in a flexible manner



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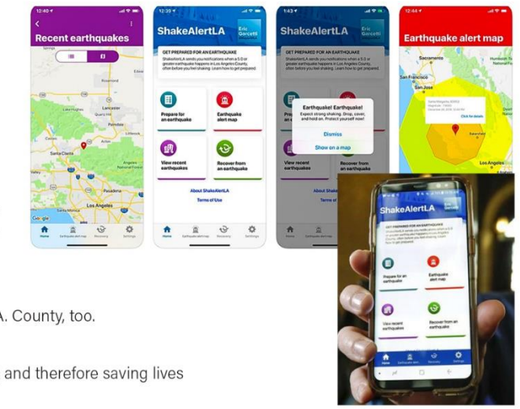
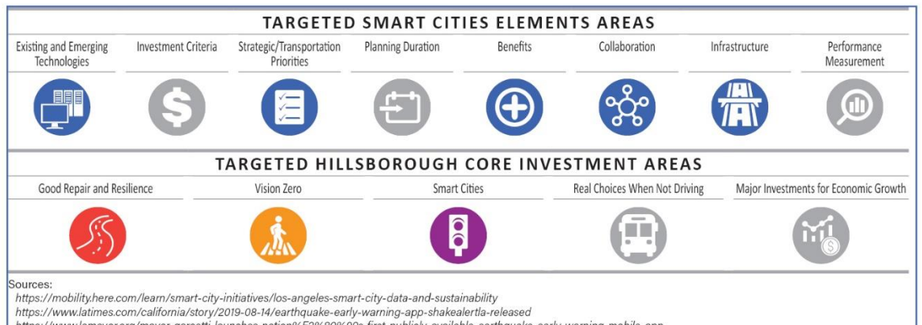
ShakeAlertLA, Los Angeles, CA

- **Background:** The city is facing challenges in day to day urban functionality such as congestion, environmental pollution, and climate change. In addition, the threat of natural disasters such as earthquake adds another layer of complication. Earthquake Early Warning (EEW) systems are effective, however, less effective for those who live closer to the epicenter of the earthquake..
- **Strategy:** The city, in collaboration with US Geological Survey (USGS), Annenberg Foundation and AT&T, developed an earthquake alert app that utilizes hundreds of sensors to collect data and send alerts to users' smartphones when a seismic activity is detected. The app also uses open-source technology and can be used outside the L.A. County, too.
- **Key Outcomes:**
  - Providing users with critical seconds of warning and therefore saving lives
  - Real-time information sharing
  - Regional collaboration and data sharing





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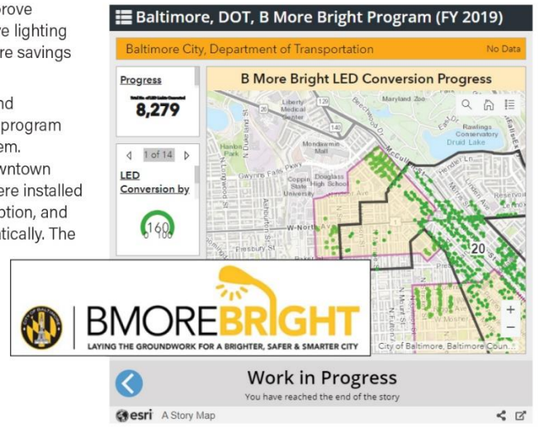
Smart Lighting Solutions

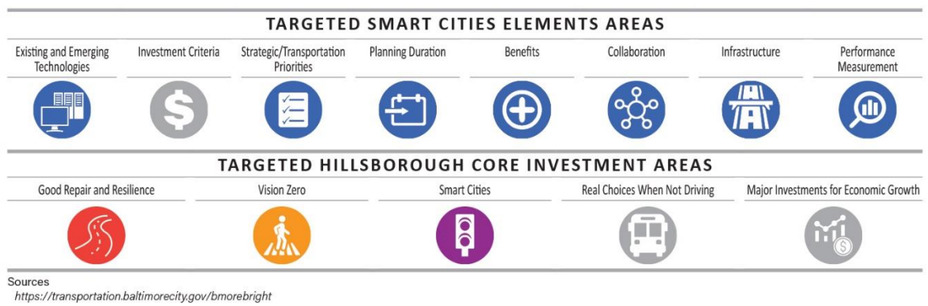
Community buildings, structures, parks and equipment play a critical role in the economic growth and the Quality of Life of a community. Smart lighting solutions can yield significant benefits by providing sense of safety, security and equity in targeted areas, as well as enabling maximized efficiency from the existing resources. Smart lighting solutions have also proven to reduce energy consumption significantly.

NATIONWIDE EXAMPLE SOLUTIONS:

Baltimore Bright Program, Baltimore, MD

- **Background:** The city of Baltimore sought to improve nighttime safety in entertainment districts, improve lighting asset management and maintenance, and measure savings of energy and money.
- **Strategy:** In collaboration with Philips Lighting and Baltimore Gas and Electric, Baltimore Bright pilot program was created to develop a connected lighting system. The program focused on 20 streetlights in the downtown entertainment district. Philips CityTouch nodes were installed that can dim or brighten, monitor energy consumption, and report outages and other technical issues automatically. The system also provided streetlight infrastructure data via wireless communications.
- **Key Outcomes:**
  - Cross-reference of 113 data points of light outages, crime, and traffic incidents
  - Improve sense of safety and security
  - Reduce maintenance costs





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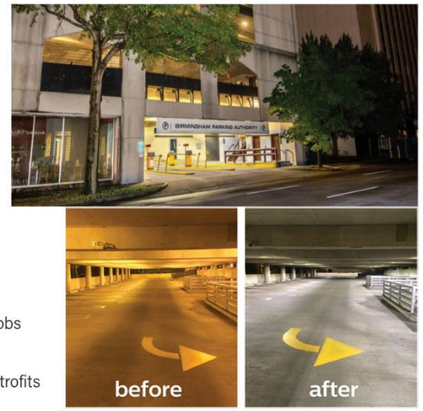
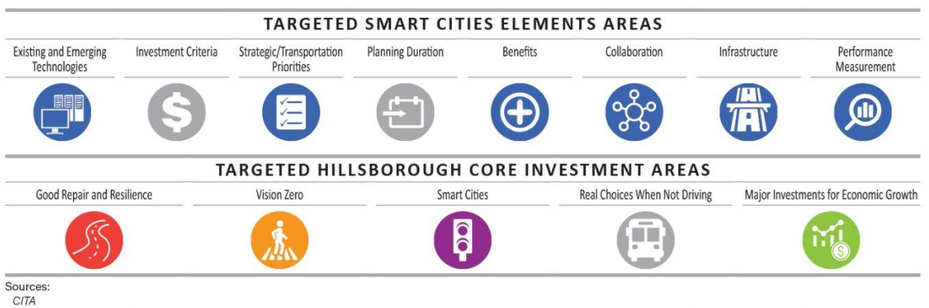
Smart Lighting Retrofit, Birmingham, AL

- **Background:** In an effort to improve safety, modernize infrastructure and engage citizens, Birmingham launched the Brighter Birmingham program. The goal was to upgrade and retrofit seven city parking garages with LED fixtures, upgrade the streetlights and highways lighting, and improve lighting in parks and architectural areas.
- **Strategy:** Through an energy audit, the implementation team identified parking garage retrofits as the fastest return on investment. Philip's Lighting, city council, parking authority and mayor's office collaborated closely and utilized a construction company and engineering team from the local market.
- **Key Outcomes:**
  - Money and energy saving
  - Improved sense of safety and security, and empowered local jobs
  - Reported increase in parking garage utilization within 5 days
  - Eliminated the need for capital expenditure by financing the retrofits through energy savings and public funds





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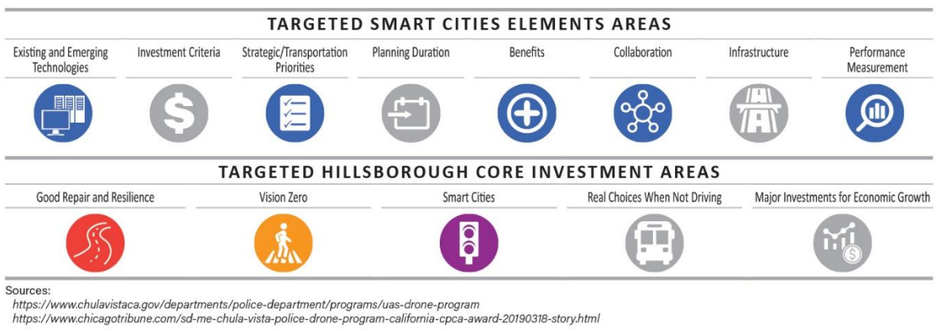
Smart Public Safety

Smart City solutions (such as IoT) connected by wireless networks offer innovative approaches in identifying danger spots and risk management for safety improvements. Video sensors through facial recognition help identify missing persons, gunshot sensors will alert law enforcement, and weather sensor technologies alert residents of natural disaster locations, provide updates and recommend safety routes. Utilizing technology for safety projects will empower communities to take proactive actions regarding their safety needs.

NATIONWIDE EXAMPLE SOLUTIONS:

Drones as First Responders, Chula Vista, CA

- **Background:** Chula Vista Police Department (CVPD) was facing a challenge in providing and maintaining safety for residents due to population growth and lack of resources.
- **Strategy:** The CVPD launched the Drone as a First Responder (DFR) program that sends a drone to the site to feed live video when an emergency call is received. The live video collects critical intelligence for the ground units and first responders. CVPD also uses the drones to search for missing or wanted persons, document crime and accident scene, respond to fires, and evaluate damage following an incident or a natural disaster.
- **Key Outcomes:**
  - Drones flown in over 1,080 missions to support patrol operations
  - First urban police response program to obtain Federal Aviation Administration approval to fly beyond visual sight lines



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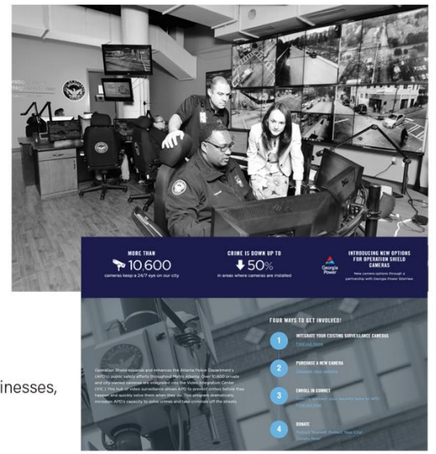
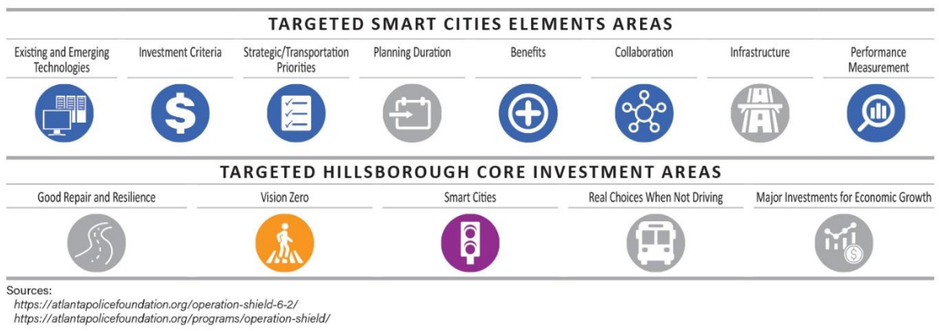
Atlanta Police Foundation Operations Shield, Atlanta, GA



- **Background:** The City needed to expand the city's surveillance efforts in a cost-effective manner to improve safety and protection for residents resulting in the Atlanta Police Foundation utilizing technology to address their needs.
- **Strategy:** In order to increase visibility, the Police Foundation launched the Operation Shield system. this integrated system was designed to access video resources from private and public entities into a single platform. In collaboration with public schools, departments of public works, watershed management and aviation, and the Atlanta Police Foundation, the accessed videos now stream across a mesh network, fiber and 4G connections for cloud storage. Through the security information management system, these videos can be accessed by police officers as needed.
- **Key Outcomes:**
  - Leverage security footage without maintenance cost
  - Regional collaboration and video sharing between private businesses, shopping malls and housing complexes
  - Improved emergency response



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Stakeholder Partnership

Stakeholder collaboration and partnership play a key role in developing strategic goals, regional priorities, coordinating efforts, and achieving consensus. Partnerships will encourage regional data and other resource-sharing to benefit both agencies and residents. Partnerships will encourage regional data and other resource-sharing to benefit both agencies and residents.

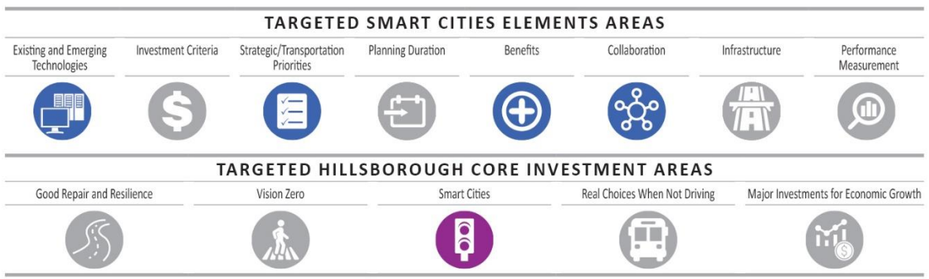
NATIONWIDE EXAMPLE SOLUTIONS:

Smart Cities Regional Initiative, San Diego, CA

- **Background:** The initiative was launched by Cleantech San Diego in collaboration with cities of Carlsbad, Chula Vista and San Diego, Port of San Diego, International Airport and SANDAG. The initiative's common goal was to facilitate local government's services in an integrated manner for connected communities, economic development, equity and inclusivity, and Quality of Life improvements.
- **Strategy:** Through this integrated collaboration initiative, San Diego transformed the regional approach in providing government services to stakeholders and residents, and has had a significant impact on the social, economic and environmental development within the region. The cross-jurisdictional collaboration has also enabled the regional stakeholders to make "smarter" and informed decisions, maximizing public funding, improving civic participation and creation of a platform that enables innovation and business growth.
- **Key Outcomes:**
  - Established a connected community through integrated services on a single platform
  - Improved equity and inclusivity, and promoted economic growth
  - Strengthened the relationship between stakeholders, businesses and residents
  - Enabled a cultural shift and therefore further harmonized agency operations

Cross-Sectoral Partnerships, Boulder, CO

- **Background:** Boulder recognized the need to develop cross-sectoral partnership within the region to develop and set the vision and priorities for Smart City deployments.
- **Strategy:** City of Boulder planned workshops and invited a wide range of institutions to participate, including government agencies, universities, private sector, and federal laboratories. The purpose was to establish a regional consensus for regional Smart Cities priorities and to identify strategies for using data to improve government programs and service-delivery.
- **Key Outcomes:**
  - Working group of diverse partners with diverse interests collaborated to create a shared vision
  - Identified priorities for the deployment of smart city technologies and strategies that the entire region can benefit from
  - Strengthened the relationship between stakeholders, businesses and residents



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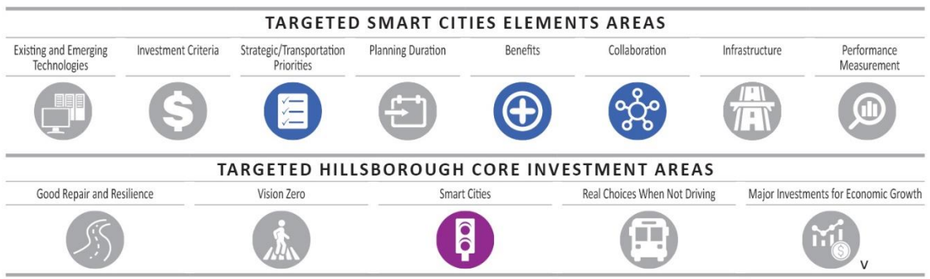

Sources:
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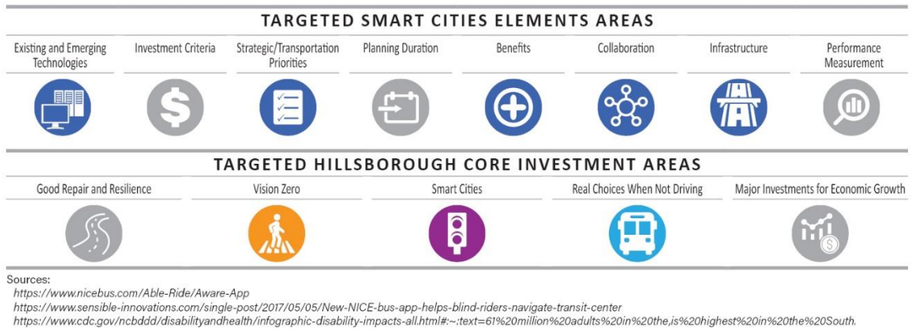
Smart Public Transit

Maintaining and navigating a transit system provides many opportunities to enhance the experience with innovative technologies. Providing smart transit options is critical to improving equity and inclusivity for those who rely on transit for their mobility needs. A successful smart transit program can be measured by performance metrics like reliability, ability to access travel information, accessibility, convenience, infrastructure quality, and quality of the rider experience. Mobile ticketing, smart screens and digital displays, and applications allowing real-time information are just a few examples of smart public transit enablers.

NATIONWIDE EXAMPLE SOLUTIONS:

Wayfinding for the Blind, Long Island, NY

- **Background:** 26% of adults in the United States have some type of disability with 4.6% having a vision disablity with blindness or serious difficulty seeing. Long island's NICE provides transit services to thousands of riders every day. This also includes riders with visual impairments. Despite the funding challenges and the growing cots of operation and maintenance, NICE recognized the importance of providing convenient service to visually impaired riders The sensors are integrated into an audible wayfinding app to use real-time data and connect users and mobile devices to transit center facilities to help them navigate their way through the Rosa Parks Hempstead Transit Center which one of the most visited transfer points.
- **Strategy:** Through partnership with Sensible Innovations, Nassau Inter-County Express (NICE) installed a smart wayfinding system to serve riders with special needs. The sensors are integrated into an audible wayfinding app to use real-time data and connect users and mobile devices to transit center facilities. They installed iBeacon low-energy electronic sensors throughout the transit center as well as the bus bays, entrances and information/ticket counters.
- **Key Outcomes:**
  - Improved equity, inclusivity, access to real-time information and convenience to riders with special needs
  - Improved transit services by connecting users and their mobile devices to transit center facilities
  - Enhance collaboration and partnership



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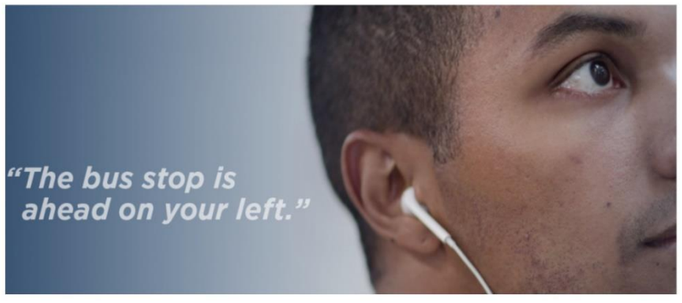

Smart Utilities

With growing populations in cities and urban areas, local agencies and city managers recognize the need to identify smart and innovative approaches to save money, optimize resources and making smart utilities projects a priority in improving efficiency and quality of life. Smart utilities technologies and strategies provide real-time data and monitoring of consumption, improve visibility and awareness on utilities usage and enable performance measurement. Connected systems improve utilities' reliability, enhance connectivity, and promote economic growth. Together with innovations such as solar power, microgrids and electric vehicles charging stations, smart utilities result in an improved level of service to the community.

NATIONWIDE EXAMPLE SOLUTIONS:

Smart Grid, Montgomery, AL

- **Background:** In a collaborative effort, Alabama Power, the City of Montgomery, Montgomery County and Montgomery Area Chamber of Commerce focused on improving the alignment and collaboration on smart community projects within the region.
- **Strategy:** The organization created the Montgomery Smart Community Alliance and identified electric grid reliability as a priority. To address this, Alabama Power deployed the Montgomery Area fiber and reliability project and sectionalized segments of the power lines for fault isolation. This helped improve the crew deployments and troubleshooting activities. The organization used the same approach in providing dark fiber connectivity for Montgomery Chamber of Commerce.
- **Key Outcomes:**
  - Increased overall reliability and Quality of Life by reducing power outages
  - Used the same fiber to improve City's public Wi-Fi network, enhanced connectivity and reduced connectivity costs
  - Improve troubleshooting activities through fault isolation
  - Enhanced economic growth
  - Expansion to smart neighborhoods

TARGETED SMART CITIES ELEMENTS AREAS

Existing and Emerging Technologies | Investment Criteria | Strategic/Transportation Priorities | Planning Duration | Benefits | Collaboration | Infrastructure | Performance Measurement

TARGETED HILLSBOROUGH CORE INVESTMENT AREAS

Good Repair and Resilience | Vision Zero | Smart Cities | Real Choices When Not Driving | Major Investments for Economic Growth

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Building Energy Benchmarking and Reporting Program, Seattle, WA

- **Background:** The city recognized that clear and accessible data can encourage energy efficiency and improvements.
- **Strategy:** Seattle's data visualization dashboard was developed with the goal of providing access to data such as addresses, floor areas, age and building-use characteristics, energy use intensity, Energy Star score, and greenhouse gas emissions. The data posted in 2015 shows an overall increase in efficiency with a drop in energy consumption for the 3,300 properties listed on the dashboard. The city also increased the number of Energy Star certification-eligible buildings by 13 percent between 2015 and 2016 with a 99 percent compliance rate over three years.
- **Key outcomes:**
  - Accessible dashboard for property owners, tenants, building operators, policy makers, contractors, and utilities managers to filter, download and sort data
  - Performance measurement, increased compliance rate, energy efficiency and consumption reduction
  - Building rating transparency and GHG emissions

TARGETED SMART CITIES ELEMENTS AREAS

Existing and Emerging Technologies | Investment Criteria | Strategic/Transportation Priorities | Planning Duration | Benefits | Collaboration | Infrastructure | Performance Measurement

TARGETED HILLSBOROUGH CORE INVESTMENT AREAS

Good Repair and Resilience | Vision Zero | Smart Cities | Real Choices When Not Driving | Major Investments for Economic Growth

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Smart Energy and Sustainability

Smart energy and sustainability strategies and technologies help cities save money, improve energy efficiency and delivery, and contribute to regional economic growth. Strategies and technologies may include EV charging stations, LED lighting retrofits, solar panel systems, and more. These tools help cities meet and advance their sustainability goals and reduce impact on natural and environmental resources. Sustainability is one of the core elements of smart cities and is also an emerging field. While urbanization continues to grow and contribute to the increased carbon emissions globally, critical actions must be undertaken to prioritize a low carbon future. Governments, cities, and stakeholders must work collaboratively to address the climate change impacts.

NATIONAL EXAMPLE SOLUTIONS:

Electric Vehicle (EV) Charging Infrastructure, San Francisco, CA

- **Background:** To provide sufficient infrastructure for EVs, the city needed a network of charging stations to meet the growing demand, as well as encouraging the EV ownership through improving access to the charging stations.
- **Strategy:** In partnership with Black & Veatch and San Francisco-based Volta Charging, the city achieved a significant expansion of Volta's network of free public charging stations. Organizations worked collaboratively to obtain the required permits and perform engineering and design activities. They also worked with businesses where stations were located to address their needs.
- **Key Outcomes:**
  - Improved access to charging stations and accelerated EV adoption
  - Clean-energy vehicle infrastructure and free charging
  - Alleviate range anxiety by rapidly scaling its portfolio of free public electric car charging stations

TARGETED SMART CITIES ELEMENTS AREAS

Existing and Emerging Technologies | Investment Criteria | Strategic/Transportation Priorities | Planning Duration | Benefits | Collaboration | Infrastructure | Performance Measurement

TARGETED HILLSBOROUGH CORE INVESTMENT AREAS

Good Repair and Resilience | Vision Zero | Smart Cities | Real Choices When Not Driving | Major Investments for Economic Growth

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Net Zero Microgrid, Denver, CO

- **Background:** Due to the rapid population growth, the city identified congestion and environmental impacts as two of the top priorities. The City and County of Denver and Excel Energy came together to find a solution that not only addresses congestion and environmental issues but also evaluates emerging technologies and provides economic benefits.
- **Strategy:** In collaboration with Panasonic CityNOW, Xcel Energy deployed a net-zero microgrid as a living lab to test smart innovations. The lab, Peña Station NEXT, is a 382-acre transit-oriented public-private development located near Denver International Airport. Other key players in this effort include Denver International Airport, RTD, Colorado DOT, Fulenwider and U.S. Department of Energy's National Renewable Energy Laboratory (NREL). This is a great example that demonstrates the importance of stakeholder alignment for success of smart city projects. The award-winning microgrid project includes a 1.6 MWdc carport solar photovoltaic (PV) system, a 259 kWdc rooftop solar PV system, a 1 MW/2 MWh battery energy storage system, and Panasonic's Technology & Business Solutions Center, which serves as the anchor electricity load.
- **Key Outcomes:**
  - The solar carport produced approximately 5 MWh per day, making the development carbon neutral
  - Solar PV at one of the locations recharges the battery and can maintain operations depending on the availability of sunshine
  - A smart streets network that integrates connected LED streetlights, environmental sensing, community WiFi, public safety, and smart parking; and an on-street deployment of V2X technology.

TARGETED SMART CITIES ELEMENTS AREAS

Existing and Emerging Technologies | Investment Criteria | Strategic/Transportation Priorities | Planning Duration | Benefits | Collaboration | Infrastructure | Performance Measurement

TARGETED HILLSBOROUGH CORE INVESTMENT AREAS

Good Repair and Resilience | Vision Zero | Smart Cities | Real Choices When Not Driving | Major Investments for Economic Growth

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Data Management

As a critical practice in development and management of smart cities, managing data is a valuable resource to unlock improvement potentials based on the performed analysis. It provides opportunities to perform accurate performance measurement and make data-driven performance-based decisions. Data management targets stakeholder collaboration and partnerships, advances utilization of existing and emerging technologies, and improves regional efforts in sharing data and resources, ensuring the different efforts support each other and help achieve overall goals and objectives. Effective data management requires development of a data strategy and reliable methods to govern, access, secure, integrate, aggregate, store for data analytics.

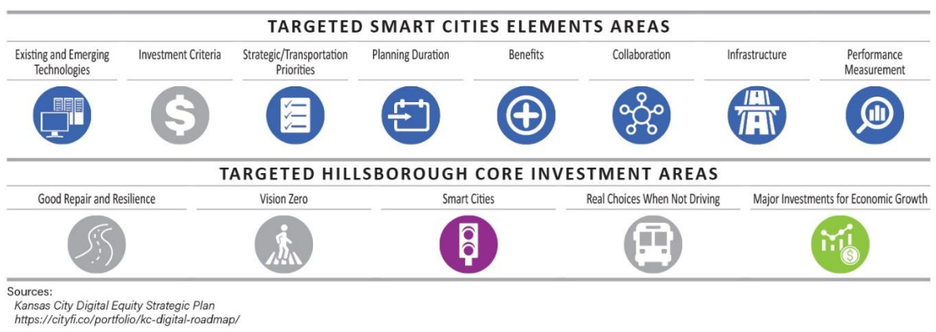
NATIONWIDE EXAMPLE SOLUTIONS:

Digital Equity Strategic Plan, Kansas City, KS

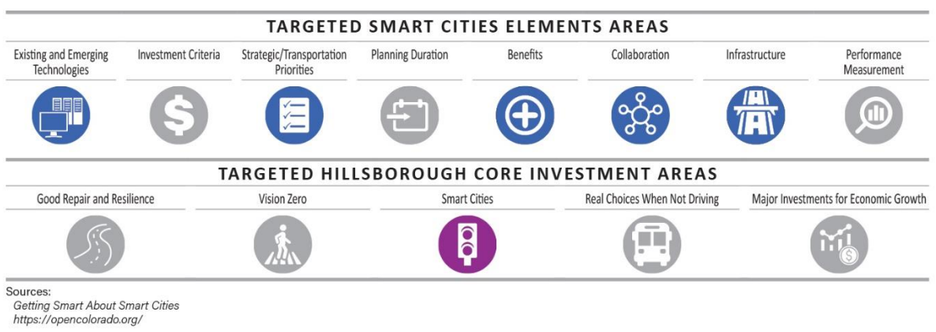
- **Background:** The purpose of the Digital Equity Strategic Plan is to address the issue of Digital Divide and data access for locals including the Mayor, City Council, City staff, corporate citizens and the community at large. It is developed to promote a shared understanding of the need for taking actions to ensure locals can access and participate in an increasingly digital society.
- **Strategy:** The Strategic Plan outlines strategies that will help create opportunities for all local residents to gain equitable access to and utilization of the digital resources. It was built upon and leveraged current and future strategic priorities, such as the City's Digital Roadmap, Smart City initiative, Community Health Improvement Plan (CHIP), Neighborhood & Housing Services Departments' Five Year Consolidate Plan and partnerships with others to engage in Digital Inclusion locally and nationally.
- **Key Outcomes:**
  - Improved Digital Equity, including but not limited to access to internet/ Wi-Fi and data
  - Developed a strategic direction with six (6) Digital Equity Policy Priorities and associated action items
  - Involved community outreach and engagement to develop a regional consensus
  - Benchmarked the current activities and identified gaps

Data Privacy Policy Protection, Boulder, CO

- **Background:** To establish privacy protection procedures and publicize privacy policies, the IT department in boulder collaborated with the city managers and agencies for a detailed review of data schema and record refresh plans before publishing their open data website.
- **Strategy:** Opencolorado.org is a platform that holds public data available and accessible to the residents. The city's IT department developed licensing terms, including terms of use, attribution and a disclaimer, and collaborated with local governments to share public information and transparency strategies.
- **Key Outcomes:**
  - Accessible data for local residents
  - Improved data sharing, protection and policy, access and transparency
  - Enhanced collaboration with stakeholders



Sources:
Kansas City Digital Equity Strategic Plan
https://cityfi.co/portfolio/kc-digital-roadmap/



Sources:
Getting Smart About Smart Cities
https://opencolorado.org/

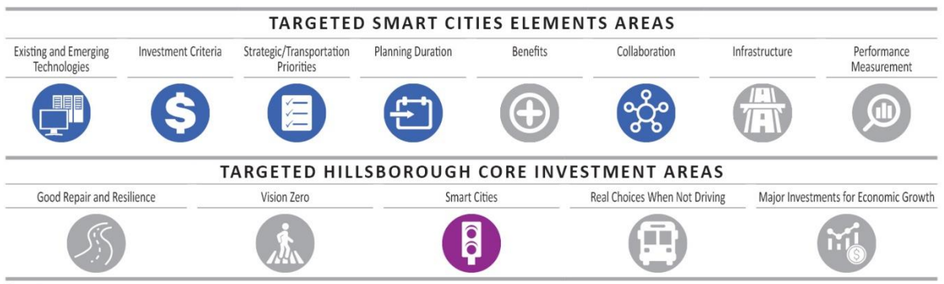
Information Communication Technology (ICT)

From smart cities initiatives, to IoT, Big Data and data management, ICT plays a key role in development and success of the success of strategies. ICT has transformed our lives within the past decades, and continues to do so as the technology advances. "Smart cities use information and communication technologies (ICT) together with other means to improve Quality of Life and efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generation with respect to economic, social and environmental aspects" (Smart Sustainable Cities: An Analysis of Definitions). IT provides the means to maintain the existing and develop future digital infrastructure required to deliver services to the community.

NATIONWIDE EXAMPLE SOLUTIONS

Establishing Working Relationships with IBM, City of Houston, TX

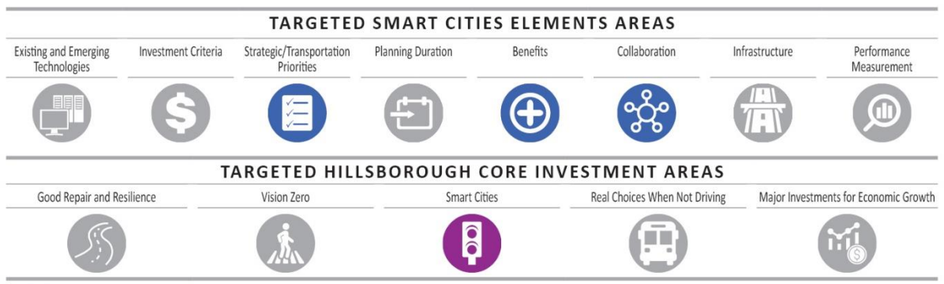
- **Background:** The City of Houston was one of the many cities that recognized the importance of developing working relationships with Tech companies to bridge the gap between government and the public sector. Local governments often do not have the resources and capacity to provide and operate smart city solutions. Therefore, the participation and partnership with private industry were identified as an essential element to the success of deployed solutions.
- **Strategy:** The City of Houston identified smart recycling and waste management as a priority. Recognizing the value of collaboration and partnership, the City sought to develop working relationships with IT organizations to help reimagine recycling and waste initiatives. As one of the IBM Smarter Cities grant recipient, the City of Houston established working relationships with IBM to perform analysis and apply lessons learned from initial testing and pilot projects. The City performed follow-up meetings and engagements to establish a better understanding of the city's needs and ultimately develop flexible solutions.
- **Key Outcomes:**
  - Enhanced working relationships and collaboration with Tech sector
  - Tech sector became a partner in developing and exploring new solutions rather than just selling, therefore established mutual wins



Sources:
Getting Smart About Smart Cities
http://www.houstontomorrow.org/livability/story/city-of-houston-receives-ibm-grant/
https://www.houstonpublicmedia.org/articles/news/2012/08/07/37188/ibm-to-provide-free-help-for-houston/
https://www.dallasweekly.com/articles/ibm-smarter-cities-challenge/

Creating Leadership Roles for IT, San Francisco, CA, City of Chicago, IL, and Boston, MA

- **Background:** With the increasing advancement in Information Technology (IT)/ICT, and the rise of big data and analytics, lack of IT skillsets and expertise is becoming problematic. Many from the private industry approach local agencies and governments with a range of new technology solutions. Many city leaders consider IT positions as service providers to other divisions and departments, and not as subject matter experts that can help develop and drive strategic priorities in smart cities. As local agencies unlock technology and data potentials, decision makers are recognizing the role of IT and the organizational changes required to accommodate IT expertise, knowledge and skillset.
- **Strategy:** Cities such as San Francisco, Chicago and Boston are embracing new roles and positions for IT. San Francisco and Chicago have hired Chief Data officers to assist and oversee their open data activities and initiatives, as well as the increasing data and IT related projects. Boston took a similar approach and hired Sustainability Data Managers who oversee and are responsible for centralizing sustainability data in the city and keep the IT community connected.
- **Key outcomes:**
  - Dedicated staff for IT and data management
  - Development of formalized roles and responsibilities for ICT/IT
  - Cultural shift in the organizational structure



Sources:
Getting Smart About Smart Cities
https://www.seedinfotech.com/importance-organization-culture/

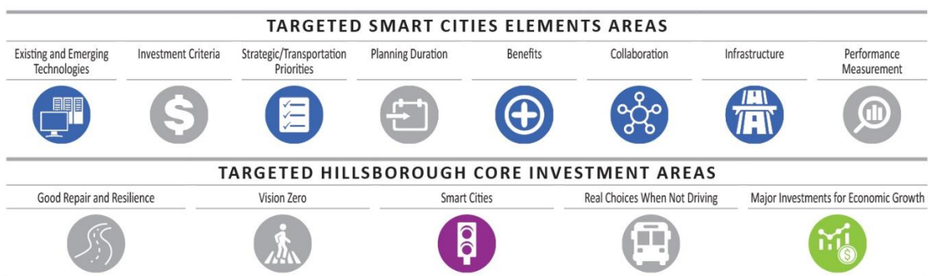
Citizens Engagement

In order to keep a consistent pace in identifying and addressing residents' needs within communities and promote economic growth, local agencies and city managers strive to utilize not only smart, but also innovative strategies and solutions to keep the community engaged. Some cities have identified enabling residents to provide feedback as well as participating in decision making process as a priority. This will also result in developing solutions that promote equity.

NATIONWIDE EXAMPLE SOLUTIONS:

Open Source/Open Data Initiatives, San Francisco, CA, City of Chicago, IL, and Boston, MA

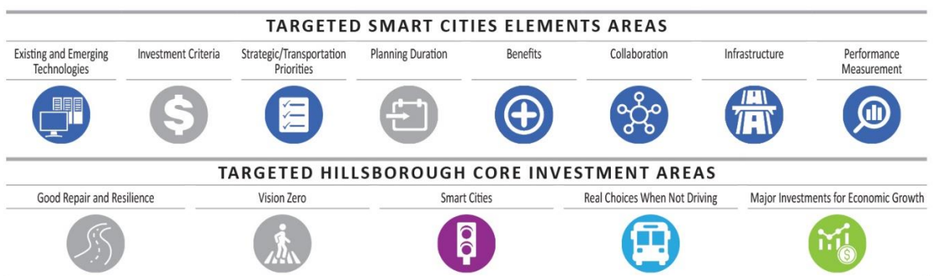
- **Background:** To enhance residents' engagement, smart cities are utilizing crowdsourcing applications and are publishing open data sets to provide platforms for information sharing and data access. These applications and initiatives have represented a significant transformation in the way local agencies interact with their residents and communities. However, in some cases, civic hackers and the unintended consequences have caused challenges in data security and privacy.
- **Strategy:** Some cities, including San Francisco, Chicago and Boston, have developed programs and policies that encourage agencies to track and publish existing and non-sensitive data to the public. The community, including residents, private vendors and entrepreneurs utilize the data to develop useful applications and perform analysis for their own purposes. For example, San Francisco released 600 data sets and as a result, dozens of smart apps have been created that help residents and communities on a daily basis. Even though the open data initiatives have helped local agencies with transparency and improved collaboration, the actions undertaken under these initiatives are time consuming and requires additional resources. To address this, cities are looking into ways to better manage and aggregate crowdsourced data and are being more strategic regarding what data sets they make available to the public.
- **Key Outcomes:**
  - Improved access to data
  - Enhanced collaboration
  - Facilitated transparency and crowdsourcing
  - Improved data management



Sources:
Getting Smart About Smart Cities
https://www.dataversity.net/intelligent-crowdsourcing-big-data-solution/

MyColumbus App, Columbus, OH

- **Background:** As stated within the city's Smart City Plan, Columbus is committed to transparency and partnership, and is comfortable and confident in sharing and using data, information and visualization to engage residents and inspire innovation. "Columbus has an active and engaged citizenry with whom the City routinely communicates through established institutional structures such as our Mobile City Hall, Neighborhood Pride, and Area Commissioners" (Smart City, The City of Columbus, p.10).
- **Strategy:** The city developed the MyColumbus app that maintains ICT data from across the city and is available to the public at a fingertip. The app provides enhanced access to the community resources including transit schedules, capital project information, 311 service requests, and more. The app also promotes environmental and personal health through providing information about local sporting events, parks, and tips for environmentally sustainable behavior. In addition, users can push and pull information through an interactive feedback loop housed within the app.
- **Key Outcomes:**
  - Robust data visualization accessible to public
  - Interactive feedback that allows data sharing (through both pulling and pushing information)
  - Winner of the 2014 Consumerization of IT in the Enterprise (CITE) Award for Best Customer App
  - Publicly available online data center, with access to zoning, aerials, traffic counts, GIS layers, and population estimates
  - Allowing users to create maps, charts and other visualizations free of charge using a variety of data and geographic areas from the Columbus region



Sources:
Columbus Smart City Plan
https://www.thecolumbusteam.com/2016/05/have-you-discovered-the-mycolumbus-app/

Smart City Maturity Model Framework/ Performance Management

Understanding and benchmarking progress prior to deployment of strategies and technologies plays a critical role to ensure activities are performance-based, are in alignment with goals and objectives, and resources are allocated efficiently to address areas of opportunity and strength. To establish a better understanding of current activities, planned future activities, address areas of strength and opportunity, and measure progress in desired outcomes, and identify the next steps, cities and agencies are developing performance measures and measures definitions. Some cities also utilize the Smart City Maturity Model Framework, a self-assessment approach to identify the level of maturity for each smart city element.

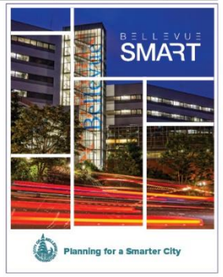
NATIONWIDE EXAMPLE SOLUTIONS:

Smart City Maturity Model Framework, Bellevue, WA

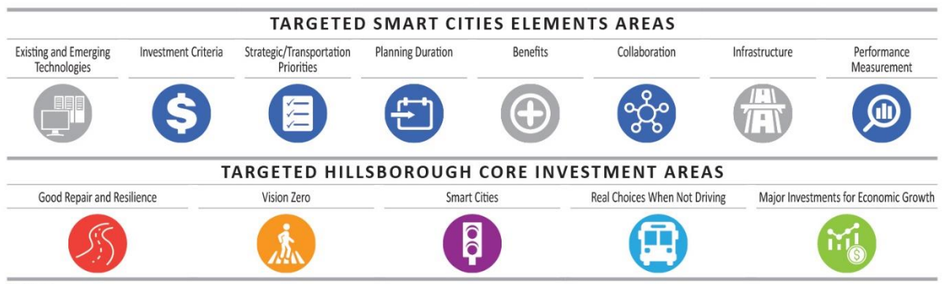
- **Background:** To establish a better understanding of the current state of the practice and development of a more tailored approach in identifying the next steps in smart city planning, Bellevue Smart utilized the framework to utilize the assessments' analysis in defining strategies. The framework utilizes five (5) levels of maturity including Level 1) Ad-Hoc, Level 2) Opportunistic, Level 3) Purposeful & Repeatable, Level 4) Operationalize/Managed, and Level 5) Optimized.

Maturity Index	1	2	3	4	5
Standard Scale	Ad-hoc	Opportunistic	Repeatable	Managed	Optimized
CONNECTIVITY					
TRANSPORTATION					
PUBLIC SAFETY					
WATER					
BUILDINGS					
ENERGY					

- **Strategy:** The plan utilized the framework to benchmark activities, measure smart city maturity, perform gaps analysis, and identify the desired level of maturity for each element within a specific timeframe. The intent was to programmatically progress towards a higher level of maturity to achieve increasing capabilities and develop strategies for resource allocation.



- **Key Outcomes:**
  - Assessed and benchmarked current state of the practice
  - Levels and gaps guided the development of strategies, including budget proposals and other funding opportunities and plans
  - Smart city elements were broken down to sub-elements for further analysis of action items required to mode towards the desired level



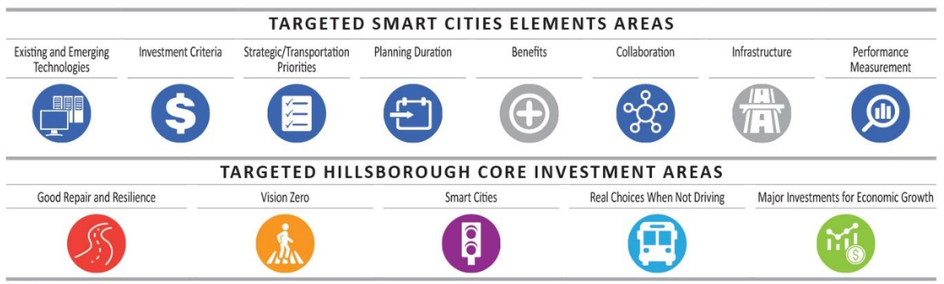
Sources:
Bellevue Smart City Plan
https://static1.squarespace.com/static/5527ba84e4b09a3d0e89e14d/t/55aebffce4b0f8960472ef49/1437515772651/UT_Smart_Model_FINAL.pdf

Transportation Systems Management and Operations (TSMO) CMM Workshop, Nevada Department of Transportation (NDOT)

- **Background:** The first step for NDOT to develop a TSMO program was the 2014 Capability Maturity Model self-assessment workshop. Under the supervision of the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO), and through research conducted by the Second Strategic Highway Research Program (SHRP 2), NDOT was one of the first DOTs selected to undertake a self-assessment workshop to evaluate the effectiveness of Nevada's transportation systems management and operations

- **Strategy:** The assessment used the CMM as a tool and estimated the extent and maturity of TSMO activities under the six key dimensions of Business Processes, Systems and Technology, Performance Measurement, Collaboration, Culture, and Organization and Staffing. These CMM dimensions are interrelated and the success of one depends on the performance of another. These six CMM dimensions are integrated formally throughout NDOT existing processes to carry out the mobility objectives.

- **Key Outcomes:**
  - Used the CMM dimensions as its framework for the statewide TSMO Program Plan to ensure the undertaking of targeted action items that will address all six dimensions.
  - Developed a formalized schedule of recurring CMM self-assessments for the TSMO Program.
  - Performed the agency's second CMM workshop in 2020 at the early stages of TSMO implementation to ensure action items are up to date considering the TSMO advancements since 2014 and are inclusive of targeting both internal and external stakeholders at a statewide level.



Sources:
NDOT Statewide TSMO Program Plan, January 2020
https://ops.fhwa.dot.gov/publications/fhwahop17017/ch3.htm
Creating an Effective Program to Advance Transportation Systems Management and Operations, FHWA, Jan 2012

Enforcement Systems

Automated enforcement systems are typically defined as using cameras to monitor and/or enforce traffic control laws. Automated speed enforcement systems include fixed cameras that can continually monitor traffic speeds without a human operator, and/or mobile camera operations, usually deployed in vehicles by law enforcement agents; and "speed-over distance" systems that photograph vehicles and measure speeds at both starting and ending points on roadways. Photographs of the speeding vehicle and license plate number are reviewed by jurisdictions, and the owner of the vehicle may receive a citation. This technology has been widely deployed, most extensively in Australia, Canada, Europe, and the United States.

Red light cameras are set up to photograph vehicles entering intersections after signals have turned red. Detection of an offense is made by sensors buried in the pavement and tied to a timing system integrating the traffic signal and pole-mounted camera. Photographs of a vehicle entering an intersection illegally and the license plate number are taken and then reviewed by the jurisdiction.

EXAMPLE SOLUTIONS:

Transport for New South Wales

- **Background:** Average speed enforcement works by measuring the amount of time it takes a heavy vehicle to drive between two points and then calculates the average speed of the vehicle. If the vehicle's average speed is higher than the speed limit for the length of road, the driver will receive a penalty for speeding.

  All average speed enforcement lengths are certified by a registered land surveyor to ensure the accuracy of average speed calculations. The distance used when calculating a vehicle's average speed across an average speed enforcement length will be the shortest practicable distance, which ensures that there is no possibility that a driver's speed can be overestimated.

- **Strategy:** As part of the Road Safety Plan 2021, average speed cameras are being expanded into metropolitan areas to address risks associated with greater truck movements. Average speed cameras are being installed on motorways and in tunnels across the Sydney Metropolitan region.

  These locations include the Cross City Tunnel, Eastern Distributor, Lane Cove Tunnel, M2 Motorway, M5 Motorway, M5 East Tunnel, M7 Motorway, Northconnex, Sydney Harbour Tunnel, WestConnex M4, WestConnex M4 – M5 Link and WestConnex M8.

  Average speed enforcement lengths are signposted. In regional locations, there's one advance warning sign on each approach that displays a camera image and the text "AVERAGE SPEED SAFETY CAMERA".

- **Key Outcomes:**
  - decrease the number of crashes
  - prevent injuries, and
  - save lives - In the 25 regional locations where average speed cameras are currently operating there has been a 44 per cent reduction in deaths from crashes involving heavy vehicles.

TARGETED SMART CITIES ELEMENTS AREAS

Existing and Emerging Technologies | Investment Criteria | Strategic/Transportation Priorities | Planning Duration | Benefits | Collaboration | Infrastructure | Performance Measurement

TARGETED HILLSBOROUGH CORE INVESTMENT AREAS

Good Repair and Resilience | Vision Zero | Smart Cities | Real Choices When Not Driving | Major Investments for Economic Growth

Sources:
Automated Enforcement: A Compendium of Worldwide Evaluations of Results - DOT HS 810 763
https://roadsafety.transport.nsw.gov.au/speeding/speedcameras/average-speed-cameras.html

Washington District Department of Transportation

- **Background:** In 1999 citywide survey, District of Columbia residents identified unsafe driving—including running red lights and stop signs—as their number one public safety concern. Sixty-two percent said unsafe driving was a serious problem in their communities. (See the results of drivers who take chances and run red lights.)

- **Strategy:** Cameras capture violations on film and record all of the relevant data for the violation. For example, when a red-light violation occurs, the camera records the date, time, vehicle's speed, and time elapsed since the beginning of the red signal. The images are then analyzed, possible extenuating circumstances are considered, and the registered owner of the vehicle is verified. A citation showing a photo of the violation is then mailed to the vehicle owner. Individuals may now view their violation images online (requires ticket number and unique personal identification number provided on the mailed citation). As of November 2020, there are 79 cameras, and the location of these cameras is publicly available. In addition, the public can make recommendations of future camera locations.

- **Key Outcomes:**
  - decrease the number of crashes
  - prevent injuries, and
  - save lives

TARGETED SMART CITIES ELEMENTS AREAS

Existing and Emerging Technologies | Investment Criteria | Strategic/Transportation Priorities | Planning Duration | Benefits | Collaboration | Infrastructure | Performance Measurement

TARGETED HILLSBOROUGH CORE INVESTMENT AREAS

Good Repair and Resilience | Vision Zero | Smart Cities | Real Choices When Not Driving | Major Investments for Economic Growth

Sources:
https://ddot.dc.gov/page/red-light-enforcement

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