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Public Safety & Street Lighting Infrastructure

Opportunities for Improving Quality of Life

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Introduction

City managers, law enforcement personnel and other stakeholders all struggle with the same problem: how best to improve public safety and quality of life for the residents of their communities. What may surprise many of them is that the street lighting infrastructure ubiquitous throughout their communities represents a huge–and largely untapped–opportunity to achieve improvements in public safety, access to broadband connectivity and other quality of life enhancements for residents. *City stakeholders can improve public safety by leveraging this street lighting infrastructure and pairing it with integrated video and sensor solutions, while engaging in proactive community engagement around these initiatives.*
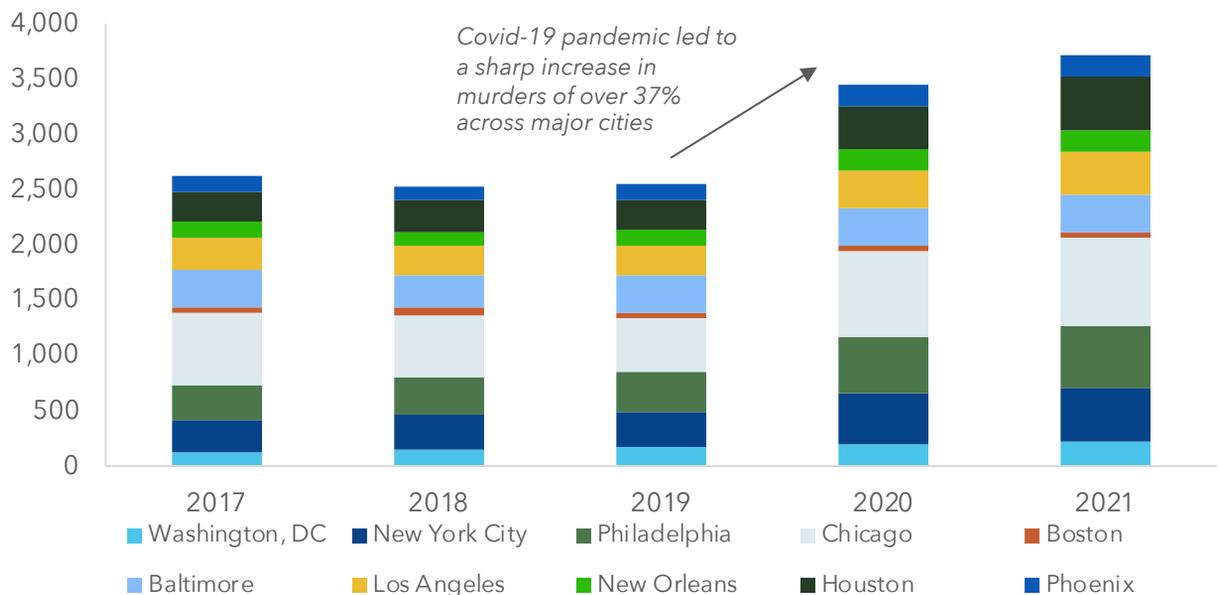
Rising crime across US cities is creating public safety challenges

Since the Covid-19 pandemic, crime statistics have taken a sharp turn for the worse

The Covid-19 pandemic has triggered a public safety crisis in many of America's cities. For most of the past 20 years, homicide and other violent crime rates had steadily declined. However, in 2020 with the onset of the pandemic this trend reversed. Across the country, there was a spike in shootings, homicides and other crimes.

Looking at a specific sample of 10 major cities across the country, there was a 37.1% rise in homicides between 2019 and 2020 when the pandemic hit. After this initial jump, the trend continued with another 5.0% rise in homicides in 2021. In New Orleans, homicides jumped 63.6% between 2019 and 2020. Other cities that saw a significant spike include Chicago (53.0%), Boston (47.4%), New York (46.7%) and Houston (45.5%), among others. The trend is concerning for stakeholders managing these cities, but an interesting opportunity for improvement lies in a once boring corner of their municipal infrastructure: streetlights.

NUMBER OF HOMICIDES (2017-2021) – 10 CITIES

*Covid-19 pandemic led to a sharp increase in murders of over 37% across major cities*

Legend: Washington, DC ■ New York City ■ Philadelphia ■ Chicago ■ Boston ■ Baltimore ■ Los Angeles ■ New Orleans ■ Houston ■ Phoenix

Source: Police departments in each city

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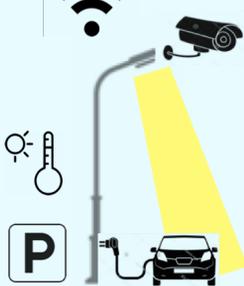## The evolution of improved public safety in street lighting
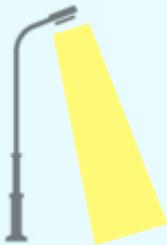
LED lighting:
- Better lighting;
- Longer lifespan and fewer outages
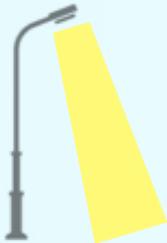
Connected lighting:
- Automatic outage detection and notification;
- Ability to brighten lights during high usage hours and emergencies

Smart city lighting:
- Streetlights can include cameras, public Wi-Fi, gunshot detection, and other sensors;
- Lighting can adapt to conditions as determined by sensors

Street lighting can be a linchpin of public safety

40 million opportunities to improve public safety

There are more than 40 million streetlights in the US, making them one of the most common features across cities of all types. Streetlights play an obvious role in public safety by providing light[1], but not all streetlights are equal. In the past decade, US cities have carried out large-scale conversions to LED luminaires, which provide better light and also last longer. By the end of 2021, over 58% of all streetlights in the US had been converted to LED. Cities and utilities are also improving upon LEDs by networking streetlights, allowing law enforcement and city managers to immediately know when a streetlight is out and to also increase lighting output during high usage or emergency situations. LED and connected streetlights also save cities as much as 80% in energy costs, freeing up funding for additional safety measures.

Public safety opportunities beyond lighting

But perhaps surprisingly, lighting is actually not the only public safety feature of the streetlight infrastructure. The ubiquity of streetlights and their height makes them an ideal backbone for smart city applications. Streetlights are well placed to house sensors for video analytics, public Wi-Fi routers, vehicle and pedestrian counting, gunshot detection, air and noise pollution monitoring, and more, while easily connecting to communications infrastructure. Addressing

[1]The exact relationship between street lighting and crime is still being studied. The most recent study from New York City showed a 36% decrease in crime by adding streetlights. While some studies have shown no effect, a meta-analysis of studies from Arizona State University showed an average 21% decrease in crime.

public safety challenges means taking advantage of–but also finding a place for–a suite of new technological options. All cities have streetlights, and the streetlight can unlock these opportunities.

Smart streetlights offer easily deployable solutions

Challenges can be overcome with the right technology

The ease of adding smart city infrastructure to street lighting has helped make these rapidly maturing technologies easier to deploy. Software is now often interoperable and smart city infrastructure can use existing communications infrastructure such as cellular networks or AMI networks from previous smart metering deployments. But smart city deployments are still new for most cities and will present challenges and concerns for city leaders. Fortunately, these concerns are already being addressed by pioneering cities. The following section will address the critical role of community engagement in carrying out all types of smart city projects. Meanwhile, technical and deployment challenges are easily being overcome through improvements in technology and by learning from examples by early-moving cities.

How can deployment challenges be overcome?

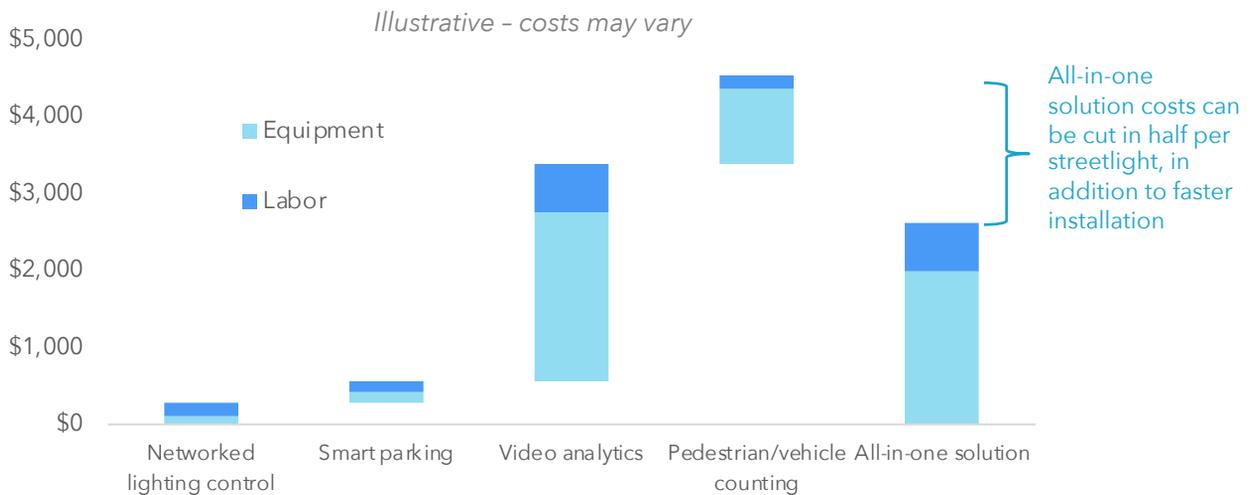| Challenges	Potential solutions
Adding new technologies to the streetscape creates clutter	Compact sensors and all-in-one solutions sit neatly on top of the streetlight almost out of view and are aesthetically pleasing
Installation of multiple types of sensors creates technical hurdles	Smart city devices are increasingly "plug and play," while new software platforms and APIs improve interoperability between sensors
Smart city devices require communications infrastructure capacity	Most cities have some level of communications infrastructure in place – either cellular, an existing mesh network for AMI, or fiber optic. Latency and bandwidth demand will help determine which communications options are best suited for each use case, but often extensive infrastructure build out is unnecessary
The myriad benefits of smart cities do not all accrue to the same departments within cities	City leadership can help overcome the siloed approach to smart cities, ensuring cost-effective benefits to law enforcement, public works, and other departments.

Unit costs come down significantly with integrated solutions

A piecemeal approach to smart city sensors results in sub-optimal solutions that offer inferior aesthetics and more expensive unit costs. An integrated, or all-in-one solution offers superior aesthetics and economics. The first simple reason for this is that installation costs must only be incurred once. Rather than repeated trucks rolls to the same streetlight to install multiple smart city sensors, just one is required. On top of this, hardware costs can be reduced. Some integrated solutions in the market today have the potential to cut in half the total costs from a piecemeal approach to smart city sensor deployments.

COSTS FOR INSTALLING SMART STREETLIGHT COMPONENTS

Illustrative – costs may vary

All-in-one solution costs can be cut in half per streetlight, in addition to faster installation

Legend:
- Equipment
- Labor

Y-axis: $0, $1,000, $2,000, $3,000, $4,000, $5,000

Categories: Networked lighting control, Smart parking, Video analytics, Pedestrian/vehicle counting, All-in-one solution

Community engagement is critical to the success of public safety initiatives

Carefully considered community engagement is imperative

Public safety initiatives that leverage technology risk community backlash without a carefully considered community engagement plan. The purpose of community engagement is to build trust. Top of mind concerns for residents including what personal data is collected, how it is used, who has access and how it is protected all need a public forum for discussion. Too often, municipal leaders proceed with new technology initiatives but fail to put in place a robust privacy policy that was created in a collaborative way with the community. This is a major oversight since, despite complaints from a vocal minority of residents, the vast majority of community members actually favor public safety initiatives such as camera technologies. For example, in two relevant polls conducted by well regarded institutions, support for cameras
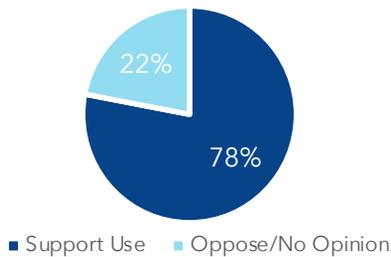
was strong. According to a *New York Times/CBS News* poll from 2013, 78% of people said cameras were a good idea in public places. In a similar vein, an *ABC News/Washington Post* poll from 2007 found 71% of Americans favor the increased use of cameras. Public support has likely only grown since these older polls given the spike in crime since the start of the pandemic. Clearly the majority of residents understand the benefits for public safety that cameras can provide. The challenge is therefore to address the concerns of those opposing it while also ensuring supporters clearly understand the safeguards in place for their personal information and privacy.

Community engagement should address both technology and process questions

An effective community engagement plan will make transparent both the technology and processes in place to safeguard citizen privacy. On the technology side of things, there are a number of ways to ensure privacy. Many solutions feature "privacy by design." One example is edge processing where video feeds remain decentralized (or "at the edge") and are not sent back to centralized storage, nor retained unless there is an incident. Only in the event of a public safety incident is video retained and used to help law enforcement. In a similar vein, some video solutions only send back meta data to central servers that does not reveal any personally identifiable information.

VIDEO MONITORING POLLING DATA

New York Times/CBS Poll

22%

78%

■ Support Use ■ Oppose/No Opinion

ABC News Washington Post Poll

29%

71%

■ Support Use ■ Oppose/No Opinion
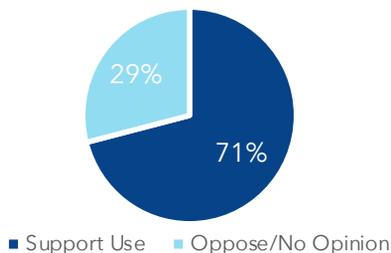
Just like technology, processes should also incorporate inherent privacy protections. First, governance structures should establish which individual has ultimate oversight and accountability, such as a Chief Data Officer (CDO) or the Chief Information Officer (CIO). From the top down, governance should be set up in such a way to ensure responsibility for protecting residents' data and that only those individuals in the city government who need access to the data for their jobs have access to it. These "data owners" have responsibility for safeguarding it. There are clearly defined roles and responsibilities and processes to ensure privacy for community members.

There is a large volume of literature available for cities to leverage to ensure their governance and processes are set up in such a way that ensures privacy. These include frameworks from the National Institute of Standards and Technology (NIST) and similar organizations seeking to establish norms and standards for protecting community members personal information.

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Practical recommendations for cities and communities

There are a few practical steps that can be taken to achieve the best outcomes with your public safety initiative. The intent of all of these centers on building community trust. These recommendations are highlighted in the following table.

RECOMMENDATIONS FOR CITIES	
1. Creation of a privacy policy	Core privacy principles/values should be defined in extensive consultation with community members. The privacy policy should be an articulation of these principles and is imperative before any technology-based public safety initiative. The policy should be written in simple, easy to understand language and avoid the use of legalese. Key elements may include ensuring equity, stating what data is collected, how it is used, who has access and how it is protected. It may also address whether facial recognition technology is or is not used, and other details.
2. Proactive community engagement and outreach	Effective community engagement is achieved by moving beyond simply informing the community of policies and initiatives and involving members in the process in a collaborative manner. It takes time, but this is the best way to build community trust.
3. Ensure technology choices align with policies	The technology selected needs to align with the privacy policy. This may include "privacy by design" where the technology features privacy as default setting, ensures end-to-end security and only collects/stores data as spelled out in the privacy policy.
4. Transparency with regards to areas that are monitored	Areas that are being monitored should be marked clearly as such and include access to further information, including a link to the city's privacy policy and what information of residents' is collected, how it is used and protected. For example, a sign could include a QR code/barcode that links to an FAQ section on the city website.
5. Ensure equity of the public safety initiative	The public safety initiative should ensure equity and not discriminate or exploit vulnerable populations. For example, cities may choose to avoid cameras near places of worship, select cultural institutions and other locations with sensitivities around religion, ethnicity, race or sexual orientation.

Cities to learn from

There is always a quest for best practices in privacy policies and community engagement. This is so cities struggling with these complex issues can learn from these exemplar cities and craft their own policies and strategies in a similar fashion. The reality is that each city is unique and while there are some common over-arching approaches, it is hard to pin down one city as a best practice to be followed by others. However, a number of cities have been cited by various studies and experts as good examples to learn from. These include Atlanta, Kansas City, New York City, Philadelphia, Portland, San Jose, Seattle and a number of others. Likely none of these cities would argue that their existing policy is a final version never to be revised in the future. But that is always the case when dealing with new technologies: we formulate the best policy we can and then revise it as necessary as circumstances evolve.