

# Rebooting NYC

## An Urban Tech Agenda for the Next Administration

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## About the Urban Tech Hub

The Urban Tech Hub of the Jacobs Technion-Cornell Institute at Cornell Tech is a new academic center of experimentation in New York City that generates applied research, fosters an expanding tech ecosystem, and cultivates the next generation of leaders in urban technology. Our goal is to shape the field of urban tech with a human-centered approach that focuses first on the people who use the technology. We advance technology research and education to build a better world by increasing access and opportunity within the tech sector.

Based at the Jacobs Technion-Cornell Institute at Cornell Tech, the Urban Tech Hub leverages the resources of Cornell University and brings together researchers, engineers, scientists, urban tech companies, government agencies, and community organizations to address the challenges facing cities today.

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# Rebooting NYC: An Urban Tech Agenda for the Next Administration

A Research Project of the Urban Tech Hub of  
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Drones inspecting building facades. A digital locker for public benefits applications. Affordable broadband for all. Fewer cars and trucks on city streets thanks to new mobility options. These are not sci-fi dreams, but real innovations using existing technologies that can be implemented in New York City by the new Mayor, City Council, and other elected officials who took office in January 2022.

*Rebooting NYC: An Urban Tech Agenda for the Next Administration* is an applied research initiative dedicated to identifying challenges facing New York City that can be addressed with existing urban technologies. While we know that not all urban problems can be solved with technology, many of them can. But implementing them will require creative thinking, close management, and innovative partnerships fostered by City government.

This project began in December 2020, long before anyone knew who would be taking office this month. Now that the Adams Administration, the new City Council, and other elected officials are all in place, it is our hope that they will consider the agenda we lay out here, with the goal of improving the quality of life for all New Yorkers.

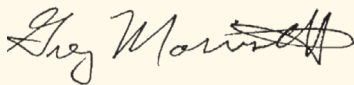
This report is the product of more than 100 interviews with tech and civic leaders, current and former government officials, and everyday New Yorkers. Our conversations focused on the challenges that technology can address in improving both the performance of urban systems and social equity in the City. While the COVID-19 pandemic has exposed deep social, economic, and racial inequities in New York, it has also accelerated the adoption of new technologies in unexpected ways. This is not intended to be a comprehensive plan, but rather an inspirational guide to the possibilities that new urban technologies can provide. The specific recommendations range in scale and scope, from the management and procurement of urban systems to the deployment of hardware such as drones for building-facade inspections to help City workers better protect and serve the public.

This report has five main areas of focus:

1. Lay the groundwork by protecting privacy and ensuring the City can implement technology effectively
2. Ensure that all New Yorkers can participate in the digital economy
3. Optimize urban systems with new technologies that are widely available and trusted
4. Expand the use of digital tools to increase public participation and expand access to government services
5. Futureproof policy to anticipate emerging technologies in advance of their arrival

The first two items are foundational requirements if we are to deploy urban tech tools and products more widely across the City. It is impossible to discuss expanding the utilization of new technologies if people do not have access to tech infrastructure in the first place. We believe, therefore, that high-speed broadband is akin to a public utility, and that we should understand the delivery of high-speed internet service to every New Yorker as a public mission, the way we see the delivery of clean water. In addition, as technologies expand, and more and more of our data is collected, the next Administration must make it a priority to protect the privacy of our personal data. Local government regards public safety as a central mission; it must see digital safety the same way.

The barriers to the adoption of new technologies are many, but so too are the opportunities. Our goal for this report is that these proposals serve as a guide for the next Administration and City Council to embrace new urban technologies. In the process, we all can work together to make New York City stronger, fairer, and more resilient.



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# Introduction

The 2021 municipal elections came at a pivotal moment for New York City. Our new Mayor, Comptroller, City Council, and other elected officials will need to lead the City's recovery from the COVID-19 pandemic. They will also inherit challenges that existed long before the coronavirus, many of which have worsened since it began. Racial inequality, struggling small businesses, a growing mental health crisis, the need for police reform—this is a formidable set of problems. New York's struggles, however, are not unique to New York. They reflect similar challenges across the country and around the world. As it has done time and again, New York must rise to the occasion and set a leading example in solving the most pressing urban concerns.

The widespread use of digital technology has improved New Yorkers' access to many goods and services, but the convenience offered by these new tech solutions has too often been accompanied by devastating side effects. While platforms like Amazon and GrubHub helped many City residents reduce their exposure to the coronavirus pandemic by offering online shopping and delivery services, the increased toll on workers and small businesses who make those services possible has meant a new set of challenges for the City. Ride-hail companies like Uber and Lyft, along with mobility services such as Citi Bike and Revel, have given New Yorkers more options for getting around. But they have also radically transformed the mix of traffic on our streets, sometimes leading to increased congestion and confusion. And this type of change isn't slowing down. A new wave of technological innovations—drones, autonomous vehicles, robots—are already poised to become part of daily urban life. Tech-driven change will only continue to accelerate.

New York City has a tremendous opportunity to show the world how to harness new technology to improve urban living. The Bloomberg Administration was adamant about fostering a robust technology ecosystem in New York, a focus that culminated in the creation of Cornell Tech on Roosevelt Island. The de Blasio Administration made great strides in centering the role of design, equity, privacy, security, and citizen engagement in the City's technology strategy. And yet, as far as the City has come in the past 20 years, there is still much to improve when it comes to its technology policies and practices.

The ultimate decision of what is right for New Yorkers is in the hands of the people and the officials they choose to elect. As researchers and practitioners in the emerging field of urban technology, we aim to offer here a set of well-considered ideas that the public and elected officials can implement.

## Our objectives

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The purpose of this agenda is to lay out a set of uses of technology that can be undertaken by New York City's incoming government to address issues of direct importance to a broad range of New Yorkers. Some proposals have their impact indirectly rather than directly,

“New York City has a tremendous opportunity to show the world how to harness new technology to improve urban living.”

but our intent has been to find opportunities where existing technology can not only enhance the effectiveness of governmental processes, but also directly improve the daily experience of City residents.

We have tried to avoid the failures of many technology visions, which frequently descend into technology for technology's sake—what some term “tech solutionism.” We have also limited our scope to technologies that are readily available, in order to meet the constraints of what can be accomplished in a four-year term of office. We have, however, included some initiatives that may not be fully completed in four years, such as those involving significant physical construction, and others, like data privacy and procurement reforms are initiatives that should be continuous in nature.

Our work builds on a rich legacy of long-range thinking voiced by diverse stakeholders in the New York City urban tech ecosystem over the last decade. Most prominent among these is BetaNYC's “People's Roadmap to a Digital New York City,” issued in 2013 during the last mayoral transition. In part because many of its recommendations remain relevant, we have focused less on digital government and open data and more on topics that the “Roadmap” did not cover, such as the use of technology to enhance city services and operations. Similarly, we have made extensive use of the “Civic Tech Field Guide,” but not attempted to duplicate it. The field guide was started at New York City's Civic Hall; one of its curators has been part of this effort. We wholeheartedly endorse both of these efforts and recommend that the new Mayoral Administration and City Council review their contents.

Similarly, we have not focused on the technology sector as a business interest. Others, such as TechNYC, are focused on the needs of the technology sector

with respect to talent, policies, and overall business environment. While technology is an important part of the New York City economy—and Cornell Tech itself represents part of the City’s commitment to that sector—our focus is on how the City makes use of, and in some cases manages, technology as a mechanism that affects how New Yorkers experience their city.

Finally, we have focused on those areas where municipal government has direct control, even if, in some cases, it still requires permission from Albany. As a result, we have not examined technology as it relates to the subways, for example; while the system is clearly vital to New Yorkers, it is not subject to real influence by the Mayor or any other municipal official. At some point, a similar effort looking at New York State might be worth undertaking.

## Our findings

Our work has led us to the conclusion that the full use of technology in New York City will be held back unless we tackle three foundational challenges that are political and administrative rather than technological: privacy, administration, and equity.

*Privacy* matters because New Yorkers are hesitant to support the greater use of urban technology in the absence of a comprehensive, credible law governing the use of data collected in the public realm. *Administration* matters because the City’s agencies are currently not fully up to the task of implementing multiple large-scale technology projects simultaneously—not due to any failure on the part of the many talented individuals working for the City, who achieve so much, but because they are constrained by a poor organizational structure and the City’s inability to hire as many technology experts as it really needs. Finally, *equity* matters because New York can never fully embrace or benefit from technology when a large portion of New Yorkers are left out of the digital economy. Solving these three challenges is a prerequisite to building out the technology-enhanced City.

If we can surmount those obstacles, there are countless ways that technology can improve the lives of New Yorkers. To give just a few examples, we can use technology to bring safety and order to our streets; to

“The full use of technology in New York City will be held back unless we tackle several challenges that are political and administrative rather than technological: privacy, administration, and equity.”

make it easier for New Yorkers to apply for benefits and services; to reduce the number of unsightly and obstructive sidewalk sheds; and to improve access to Community Board meetings. In our report, we chart a path to making New York City a place where novel, low-speed vehicles carry a large portion of our traffic, both passenger and freight, and where our building and construction industry embraces computer technology to achieve better, safer designs and faster construction times. We suggest an approach that would allow New York City to move on from a series of wars with the companies behind disruptive technologies—and then outline how the City might progress to setting rules and welcoming companies that play by those rules. Each of these individually is an incremental improvement; taken together, we believe they would transform the experience of living in this city dramatically over four years.

The first draft of this report, issued in the summer of 2021, was based on comprehensive research. We solicited the help of dozens of experts in the fields of urban tech and urban planning, many of them with deep experience managing New York City agencies or running businesses in New York. We knew, however, that a report based solely on this expertise ran the risk of not incorporating the perspectives of the full range of New Yorkers. It therefore was always part of our plan to put the draft report back out into the New York City community to get feedback on what we had written—to ask what we got right, what we got wrong, and what opportunities we had missed in our initial phase of research.



And so, after we released the initial draft of “Rebooting NYC” in the summer of 2021, we reconvened to think systematically about perspectives that might be under-represented so that we could include them in the final draft. That imperative drove our next wave of outreach. We met with a wide variety of New Yorkers for their reactions to our recommendations, representing all five boroughs—from Kingsbridge in the Bronx to St. Albans in Queens—and the full spectrum of identities and interests. During this phase of our research, we spoke with elected officials representing parts of the City far outside Midtown Manhattan, as well as with representatives of some two dozen diverse organizations and constituencies, from the Staten Island Chamber of Commerce to the Street Vendor Project to Urban Pathways, which serves the unhoused and unbanked in our city.

Our final recommendations are also influenced by our partnership in the People’s Technology Assemblies (PTA), an initiative organized by the New York City Office of the Public Advocate. Over several weeks in 2021, the PTA conducted a series of roundtable discussions with New Yorkers about the role technology plays in their daily lives, and those forums were an invaluable complement to our efforts.

And in November, the Smart Cities Urban Tech Summit convened on the Cornell Tech campus. One day of the conference was devoted to panel discussions centered on this report, and that was another opportunity to hear and be informed by diverse voices.

We listened to what New Yorkers had to say, and we have incorporated their thoughts into the final draft you see here. We hope that this is just the beginning of a longer conversation about how urban tech can truly serve all the people of our city.

# 1 Foundations: Privacy and Administration

New urban technologies offer extraordinary opportunities for New York City, from safer streets to easier access to social services to lower real estate costs. However, two concerns emerged around virtually every idea we considered. The first is that these innovations could create privacy risks for New Yorkers, giving government or private companies information about our lives that would lead to misuse and inequitable outcomes. This has already resulted in resistance to potentially helpful technologies such as sensors and cameras. The second is that, despite a track record of some significant achievements in technology, City government generally lacks the capability to implement technology solutions efficiently and to maintain and upgrade them well.

As a result, these two challenges are the starting point. Devising and enacting a major privacy law, along with reforming and reorganizing the way the City manages technology, are difficult problems that will require significant effort from both the next Mayor and the next City Council. But they are foundational. Because until New York City comprehensively addresses these two issues, it will not fully realize the promise of urban technology.

# 1.1 Enact a law regulating how City agencies and private entities gather and share data from the public realm

New York City lacks a clear and effective approach governing the collection and use of data from the public realm and from residents' interactions with City government. As a result, legitimate questions about privacy stymie the adoption of productive urban technologies and pertinent data-sharing among City agencies. To protect appropriate levels of privacy while enabling the City to make use of technology effectively, the City Council should enact a robust law governing the way data from the public realm is collected and used by both City government and private entities. This law would impose oversight on all new data-collection and data-analysis activities; put limits on how agencies can share data, and with whom; and require the public disclosure of all private data collection undertaken in the public realm.

## The problem we face

A key function of municipal government is to collect data and use it to manage and improve city operations. What buildings are being built and where, whether restaurants are following safe food-handling practices, where garbage needs to be picked up, who needs help feeding their kids, who owes what in taxes—these are all, fundamentally, issues that are driven by the gathering of information about who is doing what, at what time and in what manner, in the City. As long as the data is used responsibly, the more usable information the City government has, the better it will be able to do its job.

At the same time, as residents of a democratic city, we expect our privacy to be respected. What we mean by “private”, however, is not clear-cut; in fact, our expectations for how we share information with the City is full of contradictions. We expect that we can walk around the city without being tracked; but we also generally accept that cameras can record, for example, who goes in and out of a place of business in case a crime is committed. We understand that we have to submit information about our income to the City to determine our taxes, but we expect that information to be well guarded. We expect that who we vote for is completely confidential; but we also accept that our voter registration, including political party, is a matter of public record. We expect that personal information about our bodies or our families is highly confidential, yet we accept that the City may need that information to determine whether we are eligible for a benefit that might aid those with young children or those with disabilities. We expect that the City will treat our

“What we mean by “private”, however, is not clear-cut; in fact, our expectations for how we share information with the City is full of contradictions.”

financial transactions as confidential, yet we also know that the City publishes the purchase price of every homeowner's property in a searchable database.<sup>1</sup>

What makes all of this workable—and in most cases acceptable—is that we have clear and widely shared expectations for how and why information is being collected and used. We understand that the City needs to know our income in order to know that we've paid the right tax. But we do not give the City the right to make that information public, or to sell it to a marketing company, or to use it to determine where our children can go to school. The same is true for other types of data. Voter registration information is there to ensure clean elections, not to be able to profile us. Most of us applaud when closed-circuit TV (CCTV) cameras help identify the perpetrator of a crime. But we do not expect that those cameras are keeping track of our every movement, or that our daily habits are being compiled, analyzed, or sold—because that is not what we expect these cameras to be used for.<sup>2</sup>

### Contextual integrity

This concept of “privacy as contextual integrity,” developed by Cornell Tech Professor Helen Nissenbaum, helps clarify what is missing from the rules that govern how we collect and use data in New York City's public spaces.<sup>3</sup> Prior to the digital age—

“Contextual integrity helps define the social contract around the collection of data.”

really only three or four decades ago—the collection of large volumes of data was expensive and difficult. If someone wanted to track your movements, or listen to your phone calls, or analyze your finances, it would require the kind of effort and resources that rarely go unnoticed. This helped ensure that contextual integrity was difficult to violate.

Today, however, your cell phone tracks your location. Your social media posts and internet searches reveal your interests and connections. All of this data is easy to aggregate, store, and analyze for purposes that may not have been obvious when you downloaded a given app or signed into your social media account. Apps used to track exposure to COVID-19 made use of the fact that our phones can keep track of other phones we have been near. While this might be useful for tracking disease transmission, it also allows an app to figure out who our friends and associates are.<sup>4</sup> The cameras that a decade ago might have produced only a video recording for use in an investigation can now apply facial recognition to try to identify everyone they capture in real time, and record their location forever.<sup>5</sup> The simple act of digitization changes the way data can be used, which changes its import. The placing of voter information online, when it has been made available for decades in print, has triggered negative reactions given that web access and search tools mean the information is now more widely available than ever before, and thus likely to be used differently.<sup>6</sup>

While greater data accessibility has huge benefits, it also undermines the established ways we have accepted the gathering and use of data about who we are and what we do. That's why contextual integrity is such a useful concept in navigating the new landscape of digital privacy. It helps define the social contract around the collection of data—and clarifies that legit-

### Definitions

**MOIP:** Mayor's Office of Information Privacy.

**CPO:** Chief Privacy Officer, appointed by NYC's Mayor.

**Identifying Information Law:** Local Laws 245 and 247 of 2017. Requirements for agency collection and/or disclosure of personal identifying information.

**Citywide Privacy Protection Policies and Protocols:** Guidance issued by CPO on protection of personal identifying information.

**COPIC:** Commission on Public Information and Communication.

**CEQR (City Environmental Quality Review):** Process for City agencies to review proposed discretionary actions to identify environmental effects.



**Cameras are everywhere in New York, but no clear standards exist for how the data they capture is handled.**

Photo credit: Ben Oldenburg.

imate data collection and use depends on the public's understanding of what is, and is not, the purpose for which the data is being collected.

It is important to note that not all new uses of data constitute a violation of contextual integrity. If information is already in the public record, further use should pose no ethical issues; thus, the digitization of property records or voter rolls is not a violation.<sup>7</sup> If data is truly anonymized, there are no consequences to the individual, so there is no violation. And there are likely to be many other instances where transparency leads to a new understanding of data collection that simply redefines what people expect. For example, the use of “find my phone” systems (and the ability to turn them off) has meant that people are increasingly aware of, and comfortable with, the fact that their phone knows where they are and have been.

There are, however, emerging instances in which the unexpected (although not illegal) use of data violates contextual integrity. The Human Resources Administration (HRA) uses income tax data provided directly by New York State to check whether Medicaid recipients meet the eligibility requirements.<sup>8</sup> Landlords at several rent-regulated buildings in New York City have installed or sought to install facial recognition systems that could record residents' movements and track how often they stayed in their apartments.<sup>9</sup> The

switch to electronic-fare collection systems on transit has meant that Metrocard data has figured in New York criminal investigations for more than 20 years.<sup>10</sup> In the 2010s, IBM used NYPD surveillance footage to develop biometric recognition systems that could search by skin tone.<sup>11</sup> All of these involve the re-use of data in ways that were unexpected by the person whose data was being collected.

NYPD's use of data highlights how the violation of contextual integrity through unexpected data use can have a wide range of consequences. While some of these are relatively minor, others could be life-altering. The accessibility of certain types of records might lead to embarrassment; other data breaches might lead to job losses or discrimination; and, when law enforcement is involved, data used out of context could lead to arrest—whether the person in question is guilty or not. The unfortunate reality is that such data is disproportionately used against those who are already most disadvantaged, both because of the weaknesses of technology and because of the way our institutions direct their power.<sup>12</sup> In 2020, NYPD monitored Black Lives Matter protesters and tracked them down by using facial recognition technology.<sup>13</sup> Some have argued that the misuse of facial recognition systems amounts to a “digital stop and frisk.”<sup>14</sup>

## “New York City’s laws have not kept up with the evolution of technology.”

Even when used with good intentions, data collected in this way can create problems, because it’s important to remember data analysis is not always reliable or unbiased. Facial recognition technology is imperfect, especially with respect to nonwhite people, so there have been a number of cases of arrests based on mistaken identity. Some tools use algorithms that rely on data that incorporate historical biases and therefore perpetuate them.<sup>15</sup> And anonymization is not always reliable, especially as the number of available datasets increases and thus the potential to de-anonymize data is always increasing. As with many automated systems, people are prone to put too much faith in technology and fail to question the results of “the computer.”

### Public data collection

Public data collection raises separate issues from the more frequently discussed issue of consumer data protection. Consumer data is what is gathered from our phones, computers, internet searches, purchases, and emails. At the heart of those transactions is a willing exchange between each individual and the provider of the service governed by “terms of service” documents (however flawed). Increasingly, governments are moving to adopt consumer protection laws that will regulate what can and cannot be captured, and what disclosures must be made to users. The European Union’s General Data Protection Regulation (GDPR) and California’s Consumer Privacy Act, have pioneered these protections.<sup>16</sup> Then-Governor Andrew Cuomo proposed a comprehensive data privacy bill, the New York Data Accountability and Transparency Act (NYDATA), in the 2022 New York State Executive Budget.<sup>17</sup> NYDATA proposes privacy protections similar to those extended under the California Consumer Protection Act and the California Privacy Rights and Enforcement Act. While the successor bill, the New York Privacy Act Bill (S.6701/A.680-A) was not enacted in the 2021 legislative session, it is likely that the same topics will be revisited in the face of continued federal inaction on consumer privacy.<sup>18</sup>

While consumer data protection is starting to be addressed, there has been less systematic work on public data—the information collected on our streets and sidewalks, in our parks and our buildings’ public spaces, and in our interactions with local government.

In these arenas, New York City’s laws have not kept up with the evolution of technology. While New York City has a privacy policy that builds on the municipal Identifying Information Law, and Mayor de Blasio created the office of Chief Privacy Officer (CPO), there are still few limitations and little oversight over how City agencies gather and make use of data.<sup>19</sup> (Notably, law enforcement data is also exempted from CPO oversight.<sup>20</sup>)

For example, NYC DOT is requiring the three companies in its e-scooter pilot to share data with the City that would allow DOT to know who is riding which scooter and where they are—all in real time. While DOT’s stated objective is to further its legitimate need to ensure that scooters are being used safely on our streets, our research team has been unable to understand clearly how DOT would make use of real-time data, which implies direct physical action against the user, rather than after-the-fact data, which would be sufficient for civil action against the companies or the user. Further, there is currently no process that requires DOT to document why it needs that information, what the agency will use the data for, who it might be shared with, and how it will be stored. The general requirement is to internally document the collections and disclosures designated as “routine” and communicate them to contractors and subcontractors. Other than the City Council’s ability to hold hearings and pass laws, there is no oversight to ensure documentation is accurate.<sup>21</sup>

The concept of contextual integrity suggests that this is a violation. While the user understands that the company operating the scooter needs to know where it is, there isn’t a clear implication that that information is being shared with government. It’s possible that users would consent to DOT knowing their location for reasons of traffic management. But they almost certainly wouldn’t think they could be tracked by the NYPD. The Identifying Information Law creates a caveat for permissions required from the agency privacy officer or the CPO for disclo-

tures to the NYPD, “in connection with an investigation of a crime,” whether committed, attempted, or impending.<sup>22</sup> This threshold does not rise to the level of probable cause necessary for a warrant. And the potential consequences of a scooter user being tracked in real time by NYPD are very different from the transportation-regulation purposes that might be assumed from a DOT data-collection effort.

There is even less oversight regarding how private entities collect data in our public spaces. Little prevents the owners of the City’s countless CCTVs from storing and analyzing their data, pooling it, and creating a searchable database of images that are linked. Nothing prevents businesses from identifying your phone’s Wi-Fi, Bluetooth, or cellular connection and storing that information to see how often you access it, and when, and with whom.<sup>23</sup> In fact, the ubiquity of cameras and sensors ensures that we are often unaware of when we are being observed, and for what reason.

### City regulatory actions

In recent years, the New York City Council has enacted a series of laws and policies addressing the City’s use of data in relation to privacy. These have, in some cases, prohibited some specific, clearly objectionable behavior by private actors, such as the capturing and sale of biometric data.<sup>24</sup> However, with City agencies, the Council has leaned on disclosure as the main mechanism of legislation and shied away from actually prohibiting certain practices, largely out of deference to City agencies—above all the NYPD. This has left a fear that these regulations do not go far enough to prevent privacy-infringing actions by City agencies.

The main construct for privacy practices within City government was established by Local Laws 245 and 247 of 2017, together known as the Identifying Information Law.<sup>25</sup> This law defines the requirements for City agencies regarding the collection and/or disclosure of personal identifying information. It also created the Mayor’s Office for Information Privacy (MOIP) and office of the Chief Privacy Officer (CPO). In supplement to the law, the CPO released initial and revised versions of Citywide Privacy Protection Policies and Protocols (the Citywide Privacy Policy), last updated in February 2021, in order to guide and implement baseline compliance for privacy and security practices in a unified framework for City agencies. Executive Order

“The absence of strong privacy regulations governing data from our public realm is likely to be the single greatest barrier to the useful and effective implementation of urban technology in New York City.”

No. 34 of 2018 also places MOIP and a Citywide Privacy Protection Committee within the Office of the Mayor in recognition of the necessity of citywide coordination.<sup>26</sup>

The Citywide Privacy Policy relies largely on each agency’s Agency Privacy Officer, appointed by the agency head. In practice, the agency head determines what constitutes a “routine” or “non-routine” disclosure of sensitive information; this becomes the basis for data collection and disclosure policies. The main compliance functions are reporting requirements on their own policies to the Mayor, Council, CPO, and Committee every two years.<sup>27</sup> Ultimately, this system relies largely on the presumed good will of the Agency Privacy Officer, their independence from the agency head who appointed them, and a lack of pressure from other City agencies or City Hall.

### The need for further regulation

The absence of strong privacy regulations governing data from our public realm is likely to be the single greatest barrier to the useful and effective implementation of urban technology in New York City.

Because privacy experts and the general public do not believe that the existing laws and frameworks protect them from agency overreach, privacy concerns continue to hamper the City’s ability to adopt and deploy technology that could improve the lives of New Yorkers. Automated license plate readers have aided in solving crimes, yet when the technology itself is inaccurate—or used in connection to an unchecked system of policing that circumvents warrant require-

ments—they have engendered concern about law-enforcement overreach.<sup>28</sup> Privacy concerns have also been raised to argue that agencies should not combine and share data even where such sharing is clearly in the public interest and consistent with contextual integrity. For instance, New Yorkers presumably want the Department of Education and the Administration for Children’s Services to be sharing data about kids in need of help, and they want the Department of Finance’s property tax records to be correlated to the Department of Buildings’ construction records. But the fear that such data could ultimately be used by law enforcement (at either the city or the federal level, especially during the Trump administration) has been the basis of many of these concerns.

## The technology opportunity

Several examples and precedents exist that could be applied to ensure that New York City’s use of data is undertaken in accordance with contextual integrity. Other jurisdictions have gone further than New York in imposing restrictions on government data, and in creating processes that oversee such data. Further, New York City has existing institutions and precedents that could be applied to this challenge if considered creatively. It is actually in the field of regulating the private collection of data from public spaces that the most groundbreaking legislation is necessary, in large part because private actors may claim First Amendment freedoms around some uses.

### Other cities’ privacy review processes

Like New York, cities around the world have been wrestling with urban data over the last decade. From Barcelona and Amsterdam to Boston and Portland, cities have adopted guidelines, statements of principles, and in some cases new laws, to establish oversight over what information agencies collect and how they use it. In general, these laws have included several common aspects:

- A requirement for before-the-fact disclosures of technologies and analyses to be implemented, along with published reports outlining their benefits and risks
- An oversight entity that can review these disclosures before the agency acts, which may or may not have the ability to prevent the agency from acting
- Definitions of different rules for different agencies or types of data, depending on the sensitivity and potential harm based on either on the potency of the data itself or the potential action by the agency in question
- An advisory entity that includes the public

Some of these laws have had unintended consequences, creating ponderous processes that draw out decision-making; impose disproportionate burdens on municipal agencies; and in some cases give outsized power to a small group of advisors whose views and expertise may not be representative of or shared by a broad range of citizens. For example, Seattle’s law requires that each new technology adopted by local government be approved by the City Council, and the disclosures required of agencies have quickly mushroomed into massive reports precisely because the law sets up a review board predisposed to be against data collection. A preapproval report on law enforcement patrol car use of automated license plate readers was 349 pages long—and that was prior to input from the Community Surveillance Working Group (CSWG), which reviews such reports.<sup>29</sup> In part, this is driven by the composition of the CSWG, which is statutorily composed of seven members, of whom five must represent equity-focused groups.<sup>30</sup> While the intention was to give a “voice to members of communities historically targeted by government surveillance,” this may have created a working group that is more opposed to new technologies than the public as a whole.<sup>31</sup> As a result, the CSWG is viewed as an inherently hostile entity to most government proposals, which in turn leads proposing agencies to overinvest in reporting in an effort to defend themselves. Ensuring that oversight entities are reasonably representative of a community’s overall attitudes on privacy, while balancing the City’s best interests, is important to making such oversight effective—which means conceiving these review boards as broadly representative.



## NYC's environmental review process as a potential model

Environmental review processes offer a model for privacy reviews for City agencies. New York City's City Environmental Quality Review (CEQR) process, established in 1975 as part of the New York State Environmental Quality Review Act, requires City agencies to conduct an assessment of any actions that can have an environmental impact. It identifies three types of activity—"actions that the law says have big potential impacts" (such as building a new highway); "actions that the law says don't require environmental review" (such as repaving an existing highway); and "all other." For the first category, the required environmental reviews can run to thousands of pages and requires significant public involvement. In the last category—"all other"—most actions require only a short document demonstrating that the agency has thought through the potential implications. In these cases, there is a period during which the public can offer input, but it is up to the agency's discretion whether to incorporate it. Ultimately, the enforcement of CEQR lies with the potential for citizens and advocates to sue the City for incomplete environmental reviews.<sup>32</sup>

As a City process that has been in place for nearly a half-century, CEQR has attracted its share of critics. However, few have suggested that the overall approach of disclosure and oversight is wrong or impractical.<sup>33</sup>

While CEQR's hallmarks are disclosure and the opportunity for stakeholders to seek relief through the legal system, other oversight processes offer different approaches. The City Charter requires that all City procurement contracts be registered by the City Comptroller, giving that independent elected official the ability to delay and challenge a City purchase, although ultimately the Mayor has the power to override the Comptroller's objections.<sup>34</sup> At the State level, public authorities such as the MTA must have their major purchases approved by the Public Authorities Control Board, which is composed of a gubernatorial appointee along with members appointed by the majority and minority leaders of the State Assembly and the State Senate.<sup>35</sup> Through this mechanism, the state's political leadership exercises tremendous control over these authorities.

“Ensuring that oversight entities are reasonably representative of a community's overall attitudes on privacy, while balancing the City's best interests, is important to making such oversight effective.”

## The Commission on Public Information and Communication

The revised New York City Charter of 1989 attempted to create a layer of such oversight over City use of data through the creation of the Commission on Public Information and Communication (COPIC). COPIC's mandate was to review and monitor City policies and practices concerning public access to information, which included the publication of a publicly accessible data directory of the information maintained by the City.<sup>36</sup> Chaired by the Public Advocate, COPIC could effect a useful non-Mayoral check on the City's use of data, but a majority of its members are chosen by the Mayor. Several ambitious attempts to empower COPIC to fulfill its mandate have so far failed without sufficient budget allocation, seemingly due to the unwillingness of the de Blasio Administration to equip a non-Mayoral entity with this kind of oversight power.<sup>37</sup>

## Federal examples

At the federal level, regulation has often prioritized delineating how data can and should be shared, rather than focusing on how it should be withheld. For example, the federal Health Insurance Portability and Accountability Act of 1996 (HIPAA) governs the privacy of individual health data in the United States. Deeply concerned with the protection of individual health information, HIPAA established standards for the security of individual health data, limits on its use, and penalties for its misuse. It also established a standard process for how patients are consulted on the sharing of their data; and determined who is eligible to share such data and set standards for them to follow. HIPAA

also identified uses where the individual's consent is not needed, such as for sharing data with other medical professionals who are treating the patient; for medical insurance billing; and for some activities in the public interest such as identifying and aiding victims of domestic violence.<sup>38</sup> While HIPAA has been criticized for adding bureaucracy to medical research—often due to a misunderstanding of what it actually requires, in addition to its undeniable complexity—it has forced a deep cultural change in the medical profession that has led to patient privacy becoming a key area of focus.<sup>39</sup>

Similarly, as early as 1934, the federal Communications Act defined records of telephone calls to be private information, and strictly regulated even how telephone companies themselves can make use of this private information stored in their own records. At the same time, it also clarified that companies may use such information for billing and the prevention of fraud.<sup>40</sup>

### Regulating privately collected data in public space

While both HIPAA and the Communications Act regulate private holders of sensitive data, they do so in a context where individuals have a direct relationship with the covered entities: their phone company, their doctor, their insurance company. The regulation of data collected in public spaces by private entities is more complex, because there is no relationship between the individual and the entity. When a condo trains a CCTV camera on the sidewalk in front of its building, or an entity installs a reader that can gather information from mobile phones passing by, there is no relationship in which the passerby is offering consent—and in most cases the user is not even aware of what is going on.

It is not clear that such data collection should be banned entirely; as discussed earlier, there are many legitimate uses for CCTV and similar systems. However, in order to maintain contextual integrity, entities installing this technology must embrace transparency about what they are doing and why. Such commitments must also be enforceable, ensuring that data is not gathered for reasons tangential to the main purpose. For example, most New Yorkers would likely agree that CCTV in front of a retail store for post-event crime analysis is a legitimate use. They would also likely agree that selling that footage to a company doing

facial recognition training would exceed a legitimate rationale for a building owner to surveil a New York City sidewalk.<sup>41</sup>

Further, the regulation of private data collection must acknowledge constitutional freedoms as applied to businesses. Attempts at constraining the private use of data have been challenged and in some cases overturned based on First Amendment and Fourth Amendment rights. In the 2011 case of *Sorrell v. IMS Health*, the U.S. Supreme Court held that a Vermont law preventing pharmacies from selling personally identifiable information about drug prescriptions amounted to an unconstitutional restraint on free speech.<sup>42</sup> While scholars have debated the extent to which this case constrains other types of data-privacy laws, it is a clear indication that legislation banning the sale of data legitimately captured from the public realm will face heightened scrutiny and probably legal challenges.<sup>43</sup>

A different, but perhaps complementary approach, is to require transparency on what data is being collected. This is a common practice, reflected in NYC's Biometric Privacy Law (which requires store owners who use facial recognition to post a sign stating as much).<sup>44</sup> The challenge is that the sheer number of outdoor data collection installations requires a standardized approach to be useful to the public. One effort along these lines is the Digital Transparency in the Public Realm (DTPR) initiative, which was initiated by Sidewalk Labs but is now an open-source, Creative Commons–licensed standalone project. DTPR seeks to create a standard taxonomy for communicating to the public about what data is being collected in shared spaces, by whom, and for what purpose, and also to allow any passerby to find out more and be in touch with the collector of that data by scanning a QR code.<sup>45</sup> DTPR was piloted in 2020 by Boston's Mayor's Office of the New Urban Mechanics.<sup>46</sup> Whatever the value of DTPR's specific approach and iconography, the idea of a standard, universal approach to disclosure of public-space data collection is clearly needed in a city where such data gathering is proliferating.



In Boston, the city has been piloting a program called Digital Transparency in the Public Realm, which allows passers-by to scan a QR code for information about who is collecting data on the street.

Photo credit: New Urban Mechanics / Nayeli Rodriguez.

## An agenda for the next administration

Passing a new set of laws to ensure contextual integrity while enabling City government and private entities to advance the responsible use of urban technology is one of the major opportunities and needs facing the next City Council. This will not be a simple task. Privacy and data regulation is complex and nuanced; the massive amount of rulemaking, followed by a major legislative overhaul, that accompanied the privacy sections of HIPAA is an example of what comes about from a thorough approach to privacy legislation. As with HIPAA, enacting new restrictions will mean that some types of data are no longer available to City agencies, and that some things that were simple to access become more process-oriented. The benefits, on the other hand, are significant. They include not only the overall justice of upholding reasonable definitions of privacy, but also the potential to streamline data sharing where it is authorized and to increase public acceptance of new forms of urban technology that follow the rules.

Our work to date leads us to believe that a comprehensive set of privacy regulations should be enacted by the City Council, including four components:

### 1 Enact rules that govern how City agencies use and share data, with the objective of facilitating data use and sharing that conforms to the principles of contextual integrity

The first step for a New York City privacy act should be to legislate what New Yorkers tend to take for granted: that data collected about individuals by the City will be used only for the general stated purposes for which it is collected. While many City agencies have policies that suggest this, these policies do not have the force of law, and carry no penalty for violators. Further, the determination of which data requests are “routine” is left to the discretion of the City’s Chief Privacy Officer or to each agency’s privacy officers—who report to their respective agency commissioners.<sup>47</sup> The City Council should ensure that such policies are legislated, and not subject to change by the Mayor or commissioners.

Like HIPAA, such a law should also clearly facilitate the legitimate and secure use of personally sensitive data, and explicitly sanction the sharing of that data among certain agencies. For example, it is logical to think

that data collected by the Department of Education is collected to assist in the student's education. If that child is also being served by the Administration for Children's Services, it is reasonable to think that DOE data should be available to ACS staff, and vice versa. Similarly, DOT, the Department of Consumer and Worker Protection, and the Parks Department are all involved in the oversight of activities that take place in public spaces, such as traffic management and street vendor enforcement; it is logical to think that they could be grouped. The Departments of Buildings, Fire, Finance, and Environmental Protection all maintain detailed, but separate, records about each one of the City's million buildings; they should be encouraged to share. There are some types of City data that are unproblematically public, which should be freely shared beyond their groupings and made available outside of this legislative framework. The City should, as part of a comprehensive data audit, identify those areas in order to carve them out.

The law should also allow some City agencies to provide on-request verifications to other agencies without combining entire databases of personal information. The Department of Health and Mental Hygiene (DOHMH) holds the birth certificates of the approximately 40% of New Yorkers who were born in the City. It would be a useful service if, for example, a parent did not need to provide a birth certificate in order to register their child for school, but could instead request an electronic verification to be provided to DOE from DOHMH. Similarly, the Department of Finance might be able to use income tax records in its possession to provide on-request income verification for individuals applying for income-limited benefits. But it would be a violation of contextual integrity for DOHMH to combine its data in some wholesale way for, say, the Department of Finance to identify targets for tax audits.

At the same time, the law should create barriers around these groupings that reinforce contextual integrity; there is no reason, for example, that a New Yorker would ever assume that data provided to their child's school would be used for traffic enforcement.

Should an exception need to be made—if, for example, school attendance data ever becomes relevant to traffic laws—it should take place as a significant exception,

reported in advance to a non-Mayoral agency (recommendation #2 below). The combined data should be used for only a limited period of time and then destroyed.

Most importantly, the law must establish a requirement for a warrant for NYPD, or any other aspect of criminal law enforcement, to obtain personally identifying data from any other City agency. When concerns about privacy are raised, the risk of an inappropriate arrest, an unfairly targeted fine, or even an unwanted interaction with the police are the most commonly cited fears. The NYPD's mission—one that serves the interests of New Yorkers—is to identify and apprehend those who break the law. However, as a society we also impose barriers on the police to ensure that their investigations are appropriately narrow: this is why they are required to seek warrants to obtain private data or search private property. New Yorkers will be much more comfortable with the City collecting and using a greater set of data about them if they know that the police will need a warrant to access it.

The idea of requiring police to obtain warrants to access government datasets is increasingly common. In 2019, Utah passed the Electronic Information or Data Privacy Act which requires a warrant for accessing Utah residents' private information stored with third parties.<sup>48</sup> In 2021, Massachusetts passed the Act Authorizing and Accelerating Transportation Investment, which prevents Massachusetts transit authorities from disclosing personal information related to individuals' transit system use for non-transit purposes.<sup>49</sup> The law explicitly imposes a warrant requirement for law enforcement before they are able to access personal data collected by the authorities.<sup>50</sup> Any new legislation in New York City should also take into account the increasing prevalence of "geofence warrants"<sup>51</sup> that seek information from private companies about users in a specific geographic area, as such data requests can result in a stifling of the willingness to protest lawfully in public.

Privacy protections should also extend to agency acquisition and purchase of sensitive data from private sources. Problematic procurement and use of private sector data-driven technologies like cell-site simulators and facial recognition tools such as Clearview AI have skirted and undermined the protections of the Fourth

Amendment. At the same time, it may be that administrative enforcement—conducted by basically any entities that might impose fines but cannot arrest an individual—may have a lower barrier to data access because the consequences of their actions are not as severe.

Drafting an effective privacy law will require significant work. It should begin with the imposition of a moratorium on all new surveillance technology installations and acquisitions. This will ensure two things: that City agencies will work expeditiously with the City Council toward a new law, and that there is not a rush to acquire new technologies before the privacy law is adopted. Then, the appropriate committee should begin holding a series of hearings on the ways City agencies are currently collecting and using data, exploring especially what interagency sharing is and is not appropriate. Given the complex nature of the law, it is reasonable to expect that the moratorium and first hearings could take place no later than March or April of 2022, but that the law would not be passed until the end of 2022 or even into 2023.

## 2 Establish an oversight process for agencies that seek to deploy new data-gathering capabilities or combine datasets in new ways

A second part of the privacy law we recommend the Council to enact would cover the establishment of both an internal evaluation process for new data collection and use, as well as an external oversight mechanism that would allow that process to be challenged.

Our proposal seeks to apply the successful aspects of CEQR to City agency uses of data, while building on existing structures and applying the lessons of the various criticisms of CEQR.

First, we recommend the City Council follow the approach of Seattle and other cities, requiring that agencies seeking to deploy new data-gathering technology, combine new datasets, or deploy new automated decision-making systems undertake a

review of the privacy, equity, ethics, and other aspects of that proposed undertaking. This document, which could be called a Responsible Data Use Assessment (RDUA), would be delivered to, and certified by, the City's Chief Privacy Officer, and published for review by the public.

To benefit from the experience of CEQR, we propose that very specific guidelines be established for the contents of the RDUA, with the dual objective of ensuring that the RDUA is complete and transparent, but also that it does not grow into a massive report that no one will read. Ideally, as many items as possible would be boiled down to yes-no questions. Nissenbaum's nine-step decision heuristic can be implemented as a guideline to analyze new processes to determine if the new practice represents a potential violation of privacy.<sup>52</sup>

Where CEQR relies on legal action to provide oversight over the City's executive branch, we propose to use a revised COPIC in this role. Under the Charter, COPIC is chaired by the Public Advocate, but its majority consists of Mayoral appointees. The addition of two seats—the Comptroller and one additional member appointed by the Speaker of the City Council—would ensure that the entity has strong Mayoral representation, with a detailed understanding of the realities of municipal administration, but is not a rubber-stamp for the Mayor. (COPIC's quorum rules would need to be set such that if the several Mayoral appointees choose not to attend, the entity can still conduct business.)

Rather than review all RDUAs, which would be a significant burden and potentially cause considerable delays, we propose that the law allow the public (as well as members of COPIC itself) to identify RDUAs for COPIC consideration through a petition. In order to ensure that COPIC does not simply become a mechanism for delay, the law should give it a set period of time—such as the 30-day period allowed the Comptroller to review City contracts—and then allow the proposing agency to move forward. However, we believe that COPIC should not simply be advisory, but rather that it should have the ultimate ability to reject RDUAs and thus prevent the City from undertaking that proposed use of data.

This change in the role and composition of COPIC would require a charter amendment. We believe that the rapid and comprehensive reform of the body would enable the City to move forward in a timely manner to respond to the accelerating rate of change in the data-privacy landscape.

### 3 Enact transparency requirements for how private entities gather, share, and use data collected in the public realm, and limits on how they may use or sell data collected without consent

The City Council should enact legislation placing requirements on private entities and individuals that collect data in the public realm—that is, from people who have no direct relationship with the entity doing the collection and whose actions do not form an implied consent. This includes, for example, video collected of people on the street and cell phone information “sniffed” in public places (such as the media access control, or MAC, addresses of personal electronic devices).

The first step—necessary in part due to the constitutional protections that arise—is to assert that New York City has a clear interest in protecting New Yorkers from undue or potentially injurious surveillance. This is a fundamental responsibility to public safety that is squarely in the government’s scope.

At a minimum, such legislation should mandate widespread transparency. It should require that CCTV cameras and similar devices be labeled with easily accessible, standardized information that includes what exactly the device is; who owns and operates it, with easily actionable contact information (not shell corporations or unanswered phone numbers); what information the device is gathering; and what that information is being used for.

The second requirement should be limitations on the resale or other reuse of such data for commercial purposes based on the principle of contextual integrity.

As noted earlier, this requires the deft navigation of constitutionally protected speech. Ideally, the law could allow uses of data that are commonly accepted, while preventing other uses: for example, a “security camera” could have a defined set of requirements—such as analysis only after the fact, destruction of data after 14 days, no resale of the images or the data. Other types of devices might have different requirements based on differing expectations. For example, most New Yorkers accept that if they walk into an area where a movie is being filmed, their image may be recorded and sold as part of the movie. In that case, the rules surrounding a security camera would be inappropriate.

Depending on the way the Sorrell case is interpreted, after-capture restrictions may not be acceptable. However, it may be that the City could impose permitting requirements on those seeking to collect data in the public realm, and thus impose conditions on what data is captured and how it is used. While this may create a regulatory burden, it may be a way to avoid more straightforward laws from being challenged in court. Similarly, however, the City would need to assert a strong interest in protecting privacy in public space to have such a law apply to cameras and other sensors placed on private property but trained on public space.

## Privacy and equity concerns

As this entire section wrestles with privacy, we have not identified any additional privacy implications other than what is above.

Similarly, we do not note any aspects of this proposal that would exacerbate equity challenges.

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## 1.2 Make the City an effective purchaser, developer, and manager of technology projects

New York City government must be an effective purchaser, developer, and manager of complex technology solutions. Despite some notable achievements over the years, the agencies managing the City's technology needs are not properly organized, staffed, or equipped. As a result, the City's technology initiatives have been in many respects slow to evolve, costly, and underperforming. We recommend the appointment of a Deputy Mayor for Technology with responsibility for and control over all of the City's technology-related agencies, as well as the ability to set standards for agency-level technology systems; the permanent establishment of a New York Digital Services team; and the institution of the practice of auditing the City's technology infrastructure and investments as a regular function of the Comptroller's office.

### The problem we face

Successful management of technology will be a core aspect of municipal government in the 2020s, and New York City is often listed at the forefront of global cities embracing technology. Over the last 20 years, the City has launched 311 and NYC.gov; made more than 3,000 curated datasets available through Open Data NYC;<sup>1</sup> begun to provide free Wi-Fi through LinkNYC; worked to expand broadband access; and enabled online interactions with City government in fields ranging from paying property taxes to requesting birth certificates.

However, our interviews revealed that the City's ability to design, buy, and use technology falls short of its potential. Despite two decades of significant growth in staffing<sup>234</sup> and outside contract spending,<sup>5</sup> the City has

routinely been hampered by significant cost overruns on its large technology projects,<sup>578</sup> and has yet to create an effective process for vetting, developing, and procuring emerging technology solutions. As a result, the City spends more than it needs to and gets less done than it could. Further, many agencies continue to use outdated technology and to rely on systems that do not interoperate with other City systems.

At the core of this problem are three fixable issues: challenges in hiring and retaining technical talent; an overreliance on outsourcing technology development; and an inefficient organizational structure for managing complex technology undertakings.

### Talent

The City simply does not have enough staff with up-to-date technology skills to do all the work that is needed. New York's prominence on the national stage has allowed it to attract top talent into such leadership roles as Chief Technology Officer (CTO) and (formerly) Chief Digital Officer, and there are many skilled and dedicated technology experts across multiple City agencies. However, our interviews suggest that the demand for technology expertise has far outpaced the City's ability to hire such talent. As a consequence, many of the City's technical staff lack the skills required to meet emerging technology needs. Given the pace of technological evolution and the inherent constraints of government, this is not surprising. Several alumni of City government said that public service was an inspiring and important part of their careers, but that staying too long would have led to ossification of their professional skills.

A key obstacle to recruiting tech talent for the City is the disparity in hiring practices between government and the technology industry. While it is understood that the City often pays less than the private sector, the gap can be stark when it comes to tech jobs, where the biggest players can sometimes pay two or three times more than City salaries.<sup>910</sup> Those who are willing to sacrifice pay to work in the public sector will likely be required to take a Civil Service exam administered by the Department of Citywide Administrative Services (DCAS) in order to even be eligible, as about 93% of current Department of Information Technology and Telecommunications (DoITT) employees are in positions defined as “competitive class.”<sup>11</sup> Even though most technology jobs likely fall within the “Education and Experience” category—which means the civil service “exam” is actually a credentials review—and even though a version of the test is available online, this extra hurdle is an unnecessary recruiting challenge. At the same time, while there are many civil service categories that cover technology, they are not narrow enough to be sure that a “Computer Programmer Analyst” and a “Computer Service Technician” (two DCAS job categories) are truly suited to the specific programming or systems management responsibilities their jobs require.

## Vendors

The shortage of good technology talent leads directly to the second core problem, common to many City agencies: an overreliance on and mismanagement of vendors. Technical staff with relevant skills are used where they are most acutely needed—as agency CTOs, for instance, or in special projects such as NYC Opportunity—making them unavailable to work in an ongoing way with technology vendors. City agencies thus often lack the staff capacity to closely manage tech consultants, and the resulting lack of oversight can lead to expanding budgets.

The challenge of overreliance on external vendors is evident in the Quality Control and Systems Integration contracts, which are designed to leverage external expertise to ensure that services are delivered on time and on budget, and that they are appropriately integrated into existing systems. In the private sector, firms rely on robust DevOps teams for integrating new systems. The City, however, routinely pays consultants upwards of \$300 per hour for such work,<sup>12</sup> and the need

“City agencies often lack the staff capacity to closely manage tech consultants, and the resulting lack of oversight can lead to expanding budgets.”

for this expertise is constantly expanding. Increasingly, the City relies on Master Services Agreements (MSAs), which establish prenegotiated rates for hardware and services and have the benefit of accelerating the procurement timeline for new hardware and software.<sup>13</sup> But MSAs limit vendor options and reduce transparency. In 2015, DoITT signed a five-year MSA with Dell for \$67.46 million; by the time the contract was completed, it had been modified to the tune of \$220.94 million.<sup>14</sup> DoITT signed a new five-year, \$357.31 million contract with Dell in 2020, and as of April 19, 2021, the City has already been billed for \$191.48 million.<sup>15</sup> As the terms of these contracts and exact use of funds are confidential, it is difficult to determine whether these expenditures reflect truly needed products and services or mismanagement.

As the City’s spending on technology has ballooned, DoITT has concentrated its spending in fewer, but much larger, contracts. The overall number of active contracts has declined from 667 in FY14<sup>16</sup> to 438 in FY21.<sup>17</sup> In FY14, DoITT had 46 active MSA contracts totalling \$563.54 million.<sup>18</sup> Today DoITT’s 43 MSA contracts total \$2.73 billion.<sup>19</sup>

MSAs are not the only tool the City has at its disposal to procure technology outside of traditional methods. Under a defined process conducted by the City’s Procurement Policy Board, City departments can also work with outside vendors on so-called Demonstration Projects to test innovative ideas and solutions.<sup>20</sup> In a fast-changing field such as technology, it’s easy to imagine that many technology solutions could be procured as Demonstration Projects—if the City had the internal desire and capacity to modularize technology contracts. However, of the 114,459 procurement contracts issued in FY20 across all City agencies, only three were classified as Demonstration

Projects, and none of those were under the purview of a technology department. While there are efforts in the City, such as NYC[x] Co Labs, that allow for innovative technology pilots in communities, the City has been reluctant to replicate those efforts for in-house technology, relying heavily on MSAs instead.<sup>21</sup>

## Organizational structure

The structure of the City's various agencies focused on technology is disjointed and imbalanced, leading to a lack of a common technology strategy and frequent interagency conflicts or tensions over specific projects. DoITT handles the bulk of the City's IT systems, technology-related franchises, and service contracts. The CTO is mainly a policy role within the Mayor's Office, and has recently focused on broadband access and emerging technology research. The Mayor's Office for Economic Opportunity (NYC Opportunity) is focused on initiatives that reduce inequality, but functions very much as an internal technology consulting team that has successfully applied design principles to digitizing services provided by agencies such as the Human Resources Administration (HRA). The Mayor's Office of Data Analytics (MODA) manages the City's open data initiative. The NYC Cyber Command (NYC3) is another mayoral agency that coordinates digital security across City agencies, and managed the City government's transition to remote work during the pandemic. The Chief Privacy Officer is a mainly policymaking role relating to the City's privacy and data retention policy.

The largest of the City's technology divisions is DoITT. Established by Local Law 24 of 1994<sup>22</sup> to manage the City's IT infrastructure, DoITT was primarily tasked by then-Mayor Rudolph Giuliani with evaluating, decommissioning, and replacing the City's IT systems in preparation for Y2K.<sup>23</sup> Not surprisingly, over the past two decades, DoITT's scope has expanded significantly. It now encompasses managing the City's telecommunications and cable franchise agreements; operating the City's 311 system; and overseeing the City's multimillion dollar hardware, software, and service contracts with private vendors. The department's head count has also grown dramatically. The Bloomberg Administration oversaw a fourfold increase in DoITT's full-time staff, from 286 employees in 2001<sup>24</sup> to 1,162 in 2013.<sup>25</sup> By 2020, the agency employed 1,823.<sup>26</sup>

Despite the increases in staffing, DoITT has a poor track record of managing large new technology initiatives, leading to substantial cost overruns and even criminal prosecutions.<sup>27</sup> In 2011, a consulting report commissioned by City Hall recommended that "DoITT be left in charge of areas where it does well, like supporting users and maintaining systems," but that it should not be in charge of guiding "major technological changes."<sup>28</sup> Although that report is now 10 years old, the same opinion was shared in several recent interviews conducted for this report.

The proliferation of new technology-related agencies, mostly within the Mayor's Office, suggests that City Hall does not have confidence in DoITT to continue taking on new tasks. MODA was established in 2013, the CTO in 2014, NYC3 in 2017, and the Office of Information Privacy in 2018. However, this workaround approach has not dislodged DoITT from its central role in the procurement and management of technology. Although the CTO's mandate is "developing and implementing a coordinated citywide strategy on technology and innovation,"<sup>29</sup> in practice the relatively small CTO's office has focused on broadband strategy—and the CTO actually has limited control over even that, as oversight of the companies providing internet access in New York resides with DoITT. At the same time, most City agencies have CIOs, but these report to the respective agency commissioners, and are not responsible to either DoITT or the CTO. Unless a given agency chooses to use DoITT as its technology provider, they each are generally free to make their own IT decisions.

Further, while most of the technology-related agencies report directly or indirectly to the Deputy Mayor for Operations, that office has such a broad portfolio that there is no single individual who focuses on and oversees the City's technology strategy. The lack of an articulated technology strategy and a single leader who can speak with authority means that on a wide variety of topics—such as hiring strategy, broadband strategy, and an overall approach to technology development—the City lacks a coherent vision.

## The technology opportunity

While virtually every government and private company has struggled to keep pace with the evolution of technology over the last 20 years, there are several opportunities that would allow New York City to improve its ability to purchase, develop, and manage technology.

The challenge of hiring technology talent into government is widely recognized. The most immediately relevant solutions are two federal government initiatives started during the Obama administration: 18F and the United States Digital Service (USDS). During their first years, the two organizations had slightly different missions. Housed within the General Services Administration (the federal equivalent of DCAS), 18F offered technology services to other federal agencies. USDS, housed within the Office of Management and Budget—effectively a wing of the White House itself—tackled White House priorities, often when there was a sense that the agency that would normally be in charge was unlikely to succeed on a project of national importance. Although their missions began to overlap during the Trump Administration, it is likely that the Biden Administration will expand and refine their separate purposes.<sup>30</sup>

What the organizations share is the ability to hire people outside of the constraints of the federal civil service. Both entities started out using a “tour of duty” job classification that allows federal agencies to hire individuals outside of standard civil service approaches for jobs with finite durations of no more than four years. Further, both entities strategically prioritized the creation of hiring processes designed to appeal to talented early-career technology professionals. While the federal government’s compensation could not compete with that offered by the private sector, 18F and USDS both updated their application standards, their response times, and their ability to seek out and find promising candidates in ways that drew directly from the hiring practices of technology companies.<sup>31</sup>

New York City already has a number of programs that seek to bring new talent into City government. Urban Fellows is a highly competitive program that brings recent college graduates to spend a year working in

“Improving the recruitment process to bring in a greater number of skilled technology professionals would allow the kind of co-development processes that distinguish best-in-class technology development contracts.”

City government; it attracts applicants from across the United States (and beyond), and many of its participants go on to have long careers in civil service. A similar program exists to recruit City University of New York students.<sup>32</sup> Last year, in response to the COVID-19 pandemic, the City launched the NYC[x] Innovation Fellows program with the US Digital Response to assist with City operations; its participants served essentially as technology advisors and consultants to city agencies for eight-week stints.<sup>33</sup>

Improving the recruitment process to bring in a greater number of skilled technology professionals would allow the kind of co-development processes that distinguish best-in-class technology development contracts. It is unrealistic to expect New York City’s government to develop all major software products in-house. However, the City has the potential to be a better, more hands-on manager of its vendors and to switch from rigid, large, procurement-based contracts to smaller, more iterative contracts. Traditional contracting seeks to identify what technologies need to accomplish, then hand off specifications to a vendor and wait for a solution to be delivered. It is far better to embed a City staff member who fully understands the need with the vendor. Then the staffer can work closely with the vendor to make sure that the project stays focused on its goal even as it evolves in response to new data and conditions. This is especially important when designing systems for the general public, in which user testing and iterations are important. Significantly, the MSAs should make this kind of collaboration more, rather than less, feasible. By giving the City the ability to activate and deactivate a set of different vendors quickly, it should be able to

turn large-scale projects into a series of smaller ones that allow for greater ongoing visibility, transparency, and evaluation.

Cities across the US have taken different approaches to organizing their technology functions, reflecting the difficulty of maintaining a narrow mission focus while also achieving crosscutting IT integration. Seattle's CTO leads a highly consolidated IT department, which includes managing the City's systems, overseeing purchasing of all technology equipment (including police surveillance equipment), developing privacy policy, and ensuring broad access to the internet. This wide-ranging department was highly criticized for poor management until a new director was appointed in 2019, demonstrating the power of concentrating leadership across all aspects of technology in one individual.<sup>34</sup> Chicago's mayor has gone the other direction, seeking to integrate the city's IT services with other administrative systems such as fleet and facility management, while elevating a Chief Information Officer and a Chief Data Officer to a citywide role in the mayor's office. The move was justified as a cost-cutting measure, said to save \$1 million per year.<sup>35</sup>

In other areas, New York City deals with this challenge differently. Take, for example, the office of the Corporation Counsel. This person is essentially the commissioner in charge of New York City's Law Department. But the Corporation Counsel, to ensure consistency of legal opinions and practices, also has direct authority over the legal decisions of other agencies, and as a result maintains dotted-line authority over the chief counsels of those agencies. Similarly, the Budget Director leads the Office of Management and Budget, theoretically an arm of the Mayor's office but in practice a large city agency that of course has direct influence over agency spending. As a result, these two agency heads—who in most administrations report directly to the Mayor—have the ability not only to manage their own agencies but also to enforce consistency across other agencies.

## An agenda for the next administration

To make the City a first-rate purchaser and developer of technology products, we propose a significant set of organizational changes. First, we recommend the creation of a Deputy Mayor with responsibility for and control over all of the City's technology-related agencies, as well as the ability to set standards for agency-level technology systems. In addition, we propose changing the scope of DoITT, the creation of a Broadband Development Corporation (discussed in the next chapter) and the permanent establishment of a New York City Digital Services program. These initiatives will require the joint efforts of the Mayor, the City Council, and the Comptroller.

### 1 Appoint a Deputy Mayor of Technology to manage all of the City's technology systems and policies, while focusing DoITT on the core task of providing the City's IT systems.

There was universal agreement among those interviewed for this report that the decentralization of leadership on technology in City Hall is a mistake. Thus, the key recommendation is to vest combined responsibility for technology in a single person, fully empowered to act on her or his recommendations—and fully accountable, therefore, for their success.

To achieve this, we recommend that the next Mayor appoint a Deputy Mayor for Technology. The Deputy Mayor should have direct responsibility for the key technology agencies: DoITT; MODA; the current office of the CTO; the NYC3; and the technology related staff of Opportunity NYC.

Rationalizing DoITT will be a key initial task of the Deputy Mayor. To ensure that this individual can accomplish this, we recommend that the mayor leave the role of Commissioner of DoITT as an acting role while the Deputy Mayor can determine how best to

shape the agency going forward. As recommended in our section on the digital divide (Chapter 2.1), we recommend that DoITT's oversight of telecom companies and infrastructure be turned over to a new Broadband Development Authority, which would narrow DoITT's scope. We also recommend careful consideration of whether it makes sense to separate out DoITT's public-facing functions (311, 911, and nyc.gov) into a new agency, or whether the management of those assets can be improved within DoITT. Similarly, the new Deputy Mayor should determine whether existing technology-related functions within other agencies, such as OpportunityNYC's strong technology team, should be moved into DoITT, into a mayoral office, or into a standalone agency to provide expertise and services across all of City government.

Finally, the Mayor should empower the Deputy Mayor to establish a set of standards that would apply to all agencies, not just those under the Deputy Mayor's direct oversight. In the same way that the Law Department has ultimate authority over the recommendations of each agency's counsels, the Deputy Mayor should be able to set standards for procurement, interoperability, upgrade schedules, and design and maintenance decisions related to cybersecurity.

With this broad set of agencies under the new Deputy Mayor's purview, that officeholder would be able to fulfill the CTO's stated mandate of "developing and implementing a coordinated citywide strategy on technology and innovation," as well as DoITT's charter responsibilities for the City's IT infrastructure. The CTO would be able to establish a broad, crosscutting set of standards and approaches to data and technology; lead the discussion of how the City should regulate emerging technologies; and ensure that all New Yorkers have access to the digital economy. At the same time, the smaller individual agencies would allow for the hiring of commissioners who are appropriately skilled, empowering them to focus narrowly on achieving their important goals.

## 2 Have the New York City Comptroller conduct a regular broad inventory and audit of the City's technology infrastructure and investments

The COVID-19 pandemic has highlighted the City's reliance on technology to deliver services to residents in a time of great need and limited face-to-face interactions. Technology spending has increased significantly as the City has deployed laptops and tablets to schoolchildren,<sup>36</sup> increased remote access for City employees,<sup>37</sup> and rushed to make more City services available online.<sup>38</sup> All of these actions have added to an already lengthy list of City-owned hardware and software components that must be managed for their entire life spans.

While developing and procuring new tools and services is a critical component of technology management, so too is the decommissioning of legacy technologies. An effective departmental restructuring will allow for, and require, an internal review and evaluation of the entire spectrum of hardware, software, and technology contracts under the City's purview, just as the City did for Y2K in the years leading up to the new millennium. The promise of an integrated and agile technology structure in City government will be to ensure that this type of exhaustive audit will not be needed again; that technology in the city will adapt and evolve to the growing needs and demands of the City government and its residents; and that technology will be managed effectively from its procurement to its decommissioning.

Undertaking such an audit is especially important given our recommendation above of consolidating technology under one Deputy Mayor. While centralization offers significant benefits, it also requires a counterbalance. As a result, we recommend that such an audit be done regularly by an entity outside of the Mayor's control, under a contract that allows the auditor to publish their findings without interference from the Mayor or the City's executive agencies.

Given the responsibility of the Comptroller under the City Charter to conduct audits of city agencies, we recommend that the Comptroller undertake

this function. The Comptroller's office should bring in outside technology experts as necessary, but the Comptroller's own auditing staff should also start to include enough individuals with deep state-of-the-art technology expertise to lead such audits.

### 3 Create a New York City Digital Service to inject new technology talent into City government

The next Mayor and City Council should build on the NYC[x] Innovation Fellows program to formally establish a New York City Digital Service (NYCDS) to attract leading technologists into City government. Although inspired by the federal government's USDS and 18F, the NYCDS would not seek to duplicate those entities. It would, however, embrace and scale the notion of targeted hiring on fixed-duration contracts outside of civil service processes. This would expand the number of technology experts that are available to execute the City's goals.

A highly effective use of NYCDS staff would be to replace some of the "Quality Control and Systems Integration" consultants that the City hires at great cost. Acting as advisors and co-developers, NYCDS staff could offer specialty product design and development services for agencies across the City. In this way, NYCDS would help determine how to use technology wisely, advise on projects and contracts, and provide ongoing vendor management services. (In some ways, NYC Opportunity provides these services to agencies for projects that reduce inequality, but an NYCDS would allow those services to be available across the City at greater scale.)

Additionally, NYCDS staff could be loaned to agencies for work on specific major projects, or as ongoing advisors to key officials, following the model of the Urban Fellows program.

It is important that NYCDS is not limited by starting too small. In its first two years, USDS hired more than 200 people. While the federal government is, of course, larger than New York City's, that was seven years ago, when technology was a smaller portion of overall

spending and activity than it is today. To succeed, NYCDS will require scale and breadth, and should be authorized to start with at least 100 people.

It is likely that NYCDS could be created by a Mayoral executive order, but it is possible that it may require City Council legislation, and its budget will require City Council support.

### 4 Use these additional staff to shift to a co-development model of working with vendors

Using the additional staff that NYCDS offers, the City should shift its technology-purchasing approach to incorporate greater oversight of vendors and to embrace an iterative, co-development model of technology procurement over a more rigid outsourcing model.

We recommend a review of the policies and procedures developed by the federal 18F unit established under the General Services Administration as a model for customer engagement and business services delivery for DoITT. The 18F unit has established a "De-Risking Guide" to procurement, elements of which can be found in the City's NYC Project guide for technical procurement.<sup>39 40</sup> Three critical components of the "De-Risking Guide" we wish to emphasize from our review of City and federal practices are:

1. **Product ownership:** Assigning an internal product owner responsible for the duration of the development lifecycle is critical for ensuring that products are not only delivered on time, but also that they meet the needs of end users.
2. **DevOps:** The City's systems integration specialists should be involved in software development from the outset to ensure that tools being built externally can be integrated into the City's existing infrastructure.
3. **Modular contracting:** In contrast to the City's existing trend of signing higher-dollar contracts, modular contracting breaks software development into smaller components. The internal engagement cost to the City is higher, as the City plays a greater

role in agile product development. The benefit to the City is a more agile development process, and the ability to pull away from underperforming vendors before costs spiral out of control.

## Privacy and equity concerns

We have identified no privacy issues raised by this set of proposals.

With respect to equity, the proposed NYCDS is an opportunity to recruit experienced technologists from underrepresented backgrounds into the unit in order to build diverse technology teams that are fully representative of the New York City community.

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## 2 Technology equity: Include everyone in the digital economy

A key challenge facing New York City is that so many New Yorkers do not have full access to the digital economy. The most obvious gap is in access to the internet itself, which nearly 20% of New Yorkers lack. But full integration into the digital economy goes beyond internet access. Without access to electronic payments, the 10% of New Yorkers who lack a credit or debit card are cut off from ordering goods online or ordering a Lyft or Uber. And the difficulty of receiving packages in many buildings means that many New Yorkers are unable to obtain the benefits of the on-demand economy—which are a luxury for some, but also an important means to alleviate the problem of time poverty for others.

These inequities challenge our city in two ways. First, they constitute an inequity in and of themselves, keeping some New Yorkers from obtaining some of the benefits of 21st-century living. But they also create a broader challenge to all New Yorkers. We cannot rely fully on the efficacy of digital tools to provide City services until all New Yorkers have equal access to those tools.

## 2.1 Create a Broadband Development Corporation to bring the internet to all New Yorkers

As of 2019, an estimated 27% of New York City households do not have a fixed broadband internet subscription. The de Blasio Administration's Internet Master Plan (IMP), released in January 2020, proposed a comprehensive effort to create a City-owned fiber network to fill this gap. We find that the next Mayor and City Council should pursue this vision. Realizing it, however, will require the creation of a Broadband Development Corporation (BDC) with a dedicated revenue stream and bonding authority and a multidecade mandate to create a citywide network of utility corridors. In addition, the BDC should take a role in mediating disputes between broadband providers and landlords regarding access to buildings; gathering data about broadband access; and coordinating and targeting the many City training programs that seek to foster digital inclusion.

### The problem we face

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The COVID-19 pandemic has further demonstrated the already evident need for broadband internet to support New Yorkers' access to online education, telemedicine, and a growing number of government services. Increasingly, broadband—including high speeds for both downloading and uploading data—is critical for participating in a digital economy and engaging in democracy. New York City will only be able to embrace the full potential of the internet for the provision of City services when doing so will not permanently disadvantage New Yorkers who cannot afford broadband service or whose residence or business is not served by

broadband. While traditionally considered a challenge facing only households, broadband is also increasingly a necessity for even the smallest business.

Many New Yorkers still lack a broadband connection. As of 2019, some 27% of New Yorkers have no broadband subscription at home, and 16% have no internet connection at all, including via mobile phone.<sup>1</sup> Predictably, this lack is highly correlated with income. Only half of households living in poverty have broadband, and one-third of residents who identify as Black/African American or of Hispanic origin lack broadband.<sup>2</sup> Commercial access also shows a gap: while all of Manhattan has commercial fiber access, between 9% and 12% of the census blocks in each of the outer boroughs lacks commercial fiber broadband. Those gaps include areas with strong local business communities: in Brooklyn, 7% of census blocks encompassing Business Improvement Districts lack commercial fiber, while in Queens, that number is 11%.<sup>3</sup>

The gap in broadband connectivity in New York City persists even after more than a decade of trying to achieve universal coverage through the private sector. The first high-speed internet providers were cable television companies, which used their existing networks and building connections to offer high-speed internet over coaxial cables originally designed for television signals. In 2008, the Bloomberg Administration entered into a franchise agreement with Verizon that committed the company to “pass” all homes in the city with fiber optic data lines by 2014. (“Pass” is a term of art that indicates there is fiber running in proximity to the building, but does not necessarily mean that the building is connected. That connection

## Computer ownership and internet access in New York City households, 2016-2019

	Total households in New York City	Any broadband access		Broadband access with computer		Smartphone or tablet only		Computer but no internet		Dial-up connection only		No computer	
		households	%	households	%	households	%	households	%	households	%	households	%
<b>2019</b>	3,211,033	2,697,221	84%	2,345,854	73%	351,367	11%	232,891	7%	5,018	<1%	275,903	9%
<b>2018</b>	3,184,496	2,641,836	83%	2,311,119	73%	330,717	10%	244,572	8%	3,892	<1%	294,196	9%
<b>2017</b>	3,159,674	2,573,036	81%	2,265,695	72%	307,341	10%	264,249	8%	5,635	<1%	316,754	10%
<b>2016</b>	3,114,811	2,459,515	79%	2,215,630	71%	243,885	8%	272,448	9%	10,280	<1%	372,568	12%

Data source: American Community Survey, team analysis.

is called a “network creation.”) In 2017, the City took Verizon to court, arguing that it had failed to fulfill its commitment. That led to a settlement requiring Verizon to “network create” an additional 500,000 residential dwelling units by 2023 and to prioritize installations in low-income neighborhoods or risk paying a fine.<sup>4</sup>

The City’s troubled relationship with Verizon highlights the several factors that complicate broadband connectivity. For anyone to fully access broadband, four steps are necessary. First, the network must reach the customer’s location (the “pass”). Second, their building must be connected to the network (the “network creation”). Third, the service must be affordable. And finally, the consumer must find broadband access to be useful and relevant.

### The fiber build-out is not yet complete

Our research indicates that the build-out of the basic network of broadband links to New York’s residential blocks is essentially complete. As of June 2020, the Federal Communications Commission (FCC) data shows that 99% of all NYC census blocks are served by at least three residential broadband providers.<sup>5</sup> However, a significant portion of this broadband network relies on technologies that may become obsolete in the near future. The figure above relies on the FCC’s definition of “broadband,” which has not been updated since 2015.<sup>6</sup> Data speed is measured in two directions: download speed—how fast data from the internet, such as a movie, can be downloaded to the user—and upload speed, which shows how fast data is uploaded from the user to the internet. The FCC’s 2015 standard says that a 25/3 Mbps link is sufficient—which was likely the case in 2015, when streaming video was in its infancy and Zoom meetings did not exist. Since then, however, everyday demands for internet access have been

steadily increasing at approximately 20% each year, with no signs of slowing down.<sup>7</sup> Further, the adoption of online meetings (which require two-way video streams) has highlighted the importance of upload speeds: across New York State, the COVID lockdown period in the spring and summer of 2020 saw data downloads increase by 32% and uploads increase by 54%.<sup>8</sup> As a result, the FCC’s own standards are likely to be revised upwards.<sup>9</sup>

Using a higher, more realistic threshold for what qualifies as broadband shows that New York’s network is not yet complete. Changing the definition from 25/3 Mbps to a symmetrical 100/100 Mbps would reveal that 9% of the city’s census blocks effectively lack any broadband internet provider at all.<sup>10</sup> Higher speeds, such as the “symmetrical gigabit” or “1 gig service” (roughly 1000 Mbps download, 1000 Mbps upload) that is currently the gold standard for residential internet, will make many existing connections obsolete. Internet connections provided over telephone lines (Digital Subscriber Line, or DSL) cannot provide such speeds, and coaxial cable (using cable television infrastructure) is not expected to be able to provide such speeds at high reliability with the bandwidth to serve many customers.<sup>11</sup> Future connectivity is expected to require the speed and symmetrical transmission that only fiber optic lines afford; as of this writing, residential fiber-based service is not yet deployed in 19% of census blocks in the city.<sup>12</sup>

### Building access

Cables or fiber running past a building offer no value unless they are linked to the building and its dwellings. This is the second step in network access, “network creation.” It requires coordination and cooperation between telecommunications providers and building

“Changing the definition from 25/3 Mbps to a symmetrical 100/100 Mbps would reveal that 9% of the city’s census blocks effectively lack any broadband internet provider at all.”

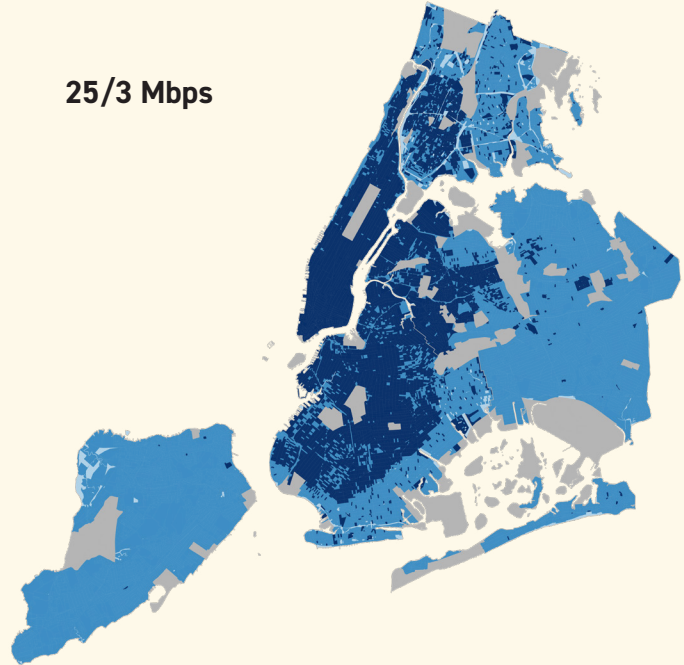
### Redefining broadband access

These maps illustrate the number of residential broadband internet providers per census block under the current definition of 25/3 Mbps, under a new definition of 100/100 Mbps, and under a definition that would require the deployment of fiber-based services capable of providing a symmetrical gigabit connection, or “1 gig fiber service.”

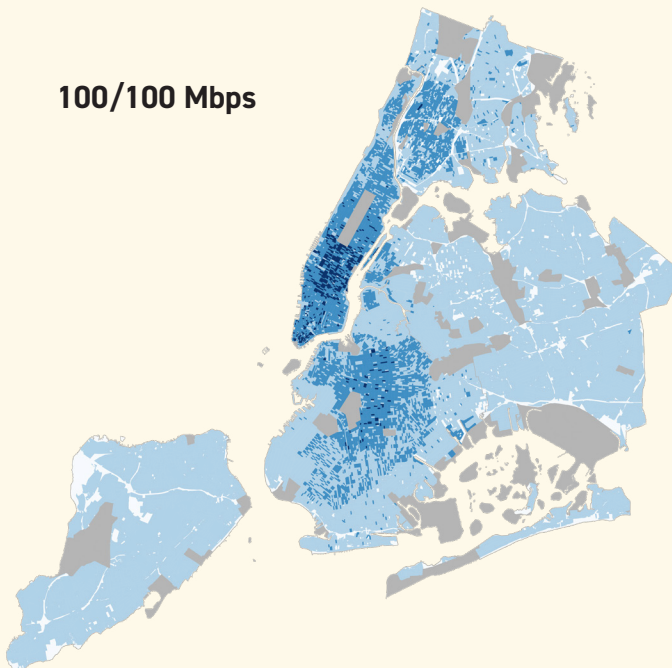
Data source: Fixed Broadband Deployment Data from FCC Form 477, June 2020, team analysis.

- 0 ISPs
- 1 or 2 ISPs
- 3 or 4 ISPs
- 5+ ISPs
- Parks, cemeteries, airports, etc.

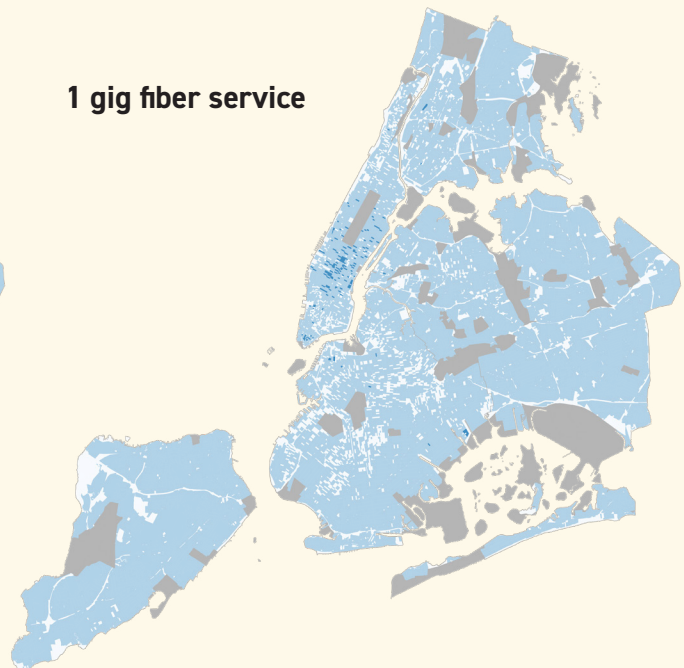
25/3 Mbps



100/100 Mbps



1 gig fiber service



“1 gig service, currently the gold standard for residential internet, will make many existing connections obsolete, because internet connections provided over telephone and cable lines cannot reliably provide such speeds.”

owners and managers. Until 2008, it was common for buildings to sign exclusive agreements with a single internet provider. While the FCC outlawed this practice in 2008, allegations have persisted that some landlords receive benefits from incumbent carriers and prevent new entrants from connecting their buildings.<sup>13</sup> This, too, is prohibited, but it requires the intervention of the New York State Public Service Commission (PSC) to adjudicate, and the PSC is ill-equipped to handle the large numbers of disputes that arise. In its year-end 2019 report to the City, Verizon reported that it had not yet obtained access to 30,163 buildings comprising 628,842 households (roughly 20% of total households in the City).<sup>14</sup> Of these, 8,405 buildings had either explicitly denied access or failed to respond to Verizon's requests for access.<sup>15</sup> At the same time, some building owners and managers claim in their complaints that Verizon has sought unreasonable accommodations, or proposed performing work that would leave buildings or interiors damaged in ways that imposed costs on the buildings.<sup>16</sup> The potential that up to one-fifth of New York households are unable to access fiber due to these disputes suggests that the issue is serious, and the long time frame required for PSC intervention suggests that existing institutional remedies are insufficient.

### Broadband affordability

Even after all buildings are connected to the network, affordability remains a hurdle. According to the IMP, broadband subscription prices range from \$50 to more than \$125 per month.<sup>17</sup> In 2019, roughly 7% of all New York households had a computer but no internet

connection.<sup>18</sup> There are three fundamental ways in which government can ensure broadband affordability: by offering subsidies to bring down prices for certain members of the public; by regulating prices (either for all users or for certain members of the public); or by intervening in the private sector to create competition. These mechanisms are not mutually exclusive, and it may be worthwhile to employ some combination of all of them.

Several programs already provide subsidies and low-cost broadband subscriptions to those who might struggle to afford broadband at market prices. Providers have traditionally offered price breaks for lower-income customers, such as Verizon's \$20 discount on FiOS plans for households that meet income guidelines for Lifeline (a longstanding program subsidizing telephone service for low-income customers) and Optimum's Advantage Internet program, which offers a 50 Mbps internet connection for \$14.99 per month to new households with children who qualify for National School Lunch Program (NSLP); seniors eligible for Supplemental Security Income; or veterans receiving public assistance.<sup>19</sup> More recently, in response to the Covid-19 pandemic, the federal government has created emergency subsidies, such as the Emergency Broadband Benefit (EBB), which offers a \$50 monthly discount on broadband to households receiving SNAP or NSLP. Eligible households can also receive a one-time discount of up to \$100 to purchase a device.<sup>20</sup> The EBB expires in March 2022 and will be replaced by a \$14 billion Affordable Connectivity Program that is part of the Infrastructure Investment and Jobs Act of 2021.

On the local level, the city provides free and low-cost broadband internet access for 40,000 residents living in NYCHA developments.<sup>21</sup> And in 2021, New York State passed legislation mandating \$15 internet service for low-income households. However, the U.S. District Court of the Eastern District of New York recently ruled that ISPs could suffer from “imminent irreparable injury” because of the law. The State indicated then that it would appeal that decision.<sup>22</sup>

Over the long term, however, affordability is likely best ensured by creating competition among internet providers. While more than 80% of the city's census blocks have fiber service, almost all of them—77% of all census blocks—have only one fiber provider.<sup>23</sup> Of

these, 72% are served solely by Verizon and only 0.4% by Optimum—a competitive provider.<sup>24</sup> Significantly, as a new entrant, Optimum is underpricing Verizon, offering its 1 Gig Internet plan over fiber at \$49.99 per month, while Verizon’s Gigabit Connection plan offers comparable speed for \$89.99.<sup>25</sup> Optimum’s lower prices suggest that competition will help keep prices for 1 gig connections down for the broad range of New Yorkers who do not qualify for subsidy programs. This is especially important as higher speeds cease to be a luxury and become more of a necessity for full use of internet services: while right now the level of competition for the most popular levels of service is robust, as standards increase, that may cease to be the case.

To address current gaps in fiber and to ensure a broadly competitive supply of fiber to New York City households in the future, the Mayor’s Office of the Chief Technology Officer (CTO) issued the City’s Internet Master Plan (IMP) in January 2020. The IMP proposes that the City develop a citywide open-access fiber-optic network reaching each intersection of the City’s streets, with the final intersection-to-building connections achieved through a mix of wired and wireless solutions. The overall cost of such a fiber network is estimated at \$2.1 billion. All told, the proposal would aim to ensure all New Yorkers have the opportunity to subscribe to fiber-based broadband services from multiple providers.<sup>26</sup> Since the IMP came out, the City has taken several steps towards implementation. Between March and April of 2021, the New York City Economic Development Corporation (EDC) and the New York City Department of Small Business Services (SBS), in partnership with the CTO, released a request for proposals (RFP) to solicit proposals for developing and managing a fiber optic broadband network on behalf of the city.<sup>27</sup> More recently, in October 2021, the Mayor announced that the City is committing \$157 million to bring the internet to 1.6 million New Yorkers in the next 36 months.<sup>28</sup>

Our interviews indicated a widespread belief that the IMP is a strong foundation on which to build the next Administration’s necessary efforts to achieve universal competitive broadband access. However, there is significant concern about the City’s governance and operational structure for ensuring the network is built, and that the IMP’s approach leaves opportunities for grid resiliency and long-term cost savings unrealized.

The most important challenge facing the IMP’s realization is that this multibillion-dollar long-term project has no dedicated revenue stream other than the City’s general funds, which may come under pressure in the post-Covid recovery period, and no institutional home that is dedicated to its realization. During the de Blasio Administration, leadership on internet strategy has alternated between DoITT and the CTO, reflecting the fact that DoITT has multiple responsibilities of dramatically varying types. Further, the overall project of a citywide fiber network is as much about construction as it is about technology, and thus lies outside many of DoITT’s core capabilities. Finally, while DoITT receives revenues from the many telecom franchises it oversees on behalf of the City, it has no dedicated revenue stream and cannot issue bonds; its financial resources are provided only by the City’s general budget. At the same time, the CTO’s office is a mayoral policy entity, equally unsuited to the task of implementing a major multiyear infrastructure project.

A second challenge is that implementing the IMP in the cheapest way possible may lead to higher costs and poor service down the road. A key challenge with laying new fiber is where it goes. New York City is served by both underground conduits (reaching 45% of the City’s land area) and overhead telephone poles (reaching 69% of the City, overlapping in places with underground coverage). Where the poles have the capacity, stringing fiber on overhead poles is much cheaper than laying it underground. In fact, Verizon’s only significant competitor in offering residential fiber outside of Manhattan and the Bronx is RCN, which predominantly utilizes overhead wires strung from utility poles. In several sections of the city served by overhead poles, these poles are congested and cannot accommodate new wires. Further, all overhead lines suffer from reliability and resiliency risks due to their severability, which has been a longstanding source of frustration outside of Manhattan, where the networks are far less vulnerable to storms due to the prevalence of underground infrastructure.<sup>29</sup>

Both DoITT and the IMP have prioritized the use of “microtrenching”—essentially, laying fiber in shallow trenches dug in the street itself—as a cost-effective way to lay fiber quickly and cheaply. However, microtrenched fiber is likely to need to be reinstalled whenever streets are reconstructed, and is susceptible

to unintentional service outages caused by the frequent utility projects that cut into New York City's streets.<sup>30</sup> The current plan also does not consider whether there is an opportunity for the City's broadband buildout to address the longstanding vulnerability of overhead electric utilities in the boroughs outside of Manhattan.

In the most commercially oriented parts of Manhattan, the Empire City Subway (ECS) system offers a successful model for how an open-access system of conduit can ensure competition and state-of-the-art service. ECS is a network of utility tunnels in Manhattan and the Bronx, constructed under a franchise agreement with the City dating to 1891. Now owned by Verizon, although still subject to City revenue-sharing and oversight, the ECS tunnels are intended to provide shared space through which new market entrants can rent conduit and pull new lines of cable in order to reach new customers without the tremendous cost of digging trenches. ECS has been critical in creating a competitive commercial fiber broadband market in areas of Manhattan. However, ECS has not carried those benefits to the broader residential market it serves outside the Manhattan central business district. A 2010 audit by then-Comptroller John Liu found that ECS was undercounting profits, thereby reducing their required revenue sharing with the city, and failing to manage and reinvest in its network.<sup>31</sup>

### Relevance, devices, and demand

Even if broadband is available and affordable, some New Yorkers may not connect. Because there are an increasing number of options for low-income New Yorkers to get broadband access at a low cost, as noted above, affordability of the broadband service by itself does not fully explain the gap in adoption. As of 2019, 9% of New York households had no internet-enabled device at all, and another 11% had only a smartphone or tablet.<sup>32</sup> If we assume that a computer and a broadband connection are both required for full access to the internet, then 20% of New York households find themselves on the wrong side of the digital divide.

Through our interviews, we attempted to understand this aspect of the digital divide. We identified three categories of users with different barriers to digital access:

- The first group of New Yorkers may be making an informed decision not to have a fixed broadband connection because their smartphone or tablet supplies what they need and want from the internet, even though they could afford a laptop. This is likely to be a subset of the 11% of New York households who have a smartphone but do not have a computer with broadband access.
- The second group of New Yorkers would like to have home internet but cannot afford a laptop, smart TV, or other device that would make home internet useful. This is likely to be a subset of the 9% of New York households that do not have a computer or smartphone.
- The final group of New Yorkers consists of those who are not really aware of the value of the internet or who are not able to use it. For some, this may be a conscious choice. Our interviews suggest that this is a relatively small group, consisting mainly of older New Yorkers and very recent immigrants from places where even smartphones are rare. While it is a reasonable assumption that these New Yorkers are hindered by affordability challenges (for both broadband access and devices), the first step to closing the digital gap for them is education and awareness.

The limitations of the data collected by the FCC and the Census have clearly hampered any effort to understand broadband access and adoption across the city. "Truth in Broadband: Access and Connectivity in New York City," a 2018 report from the CTO, uses the FCC data to document speed and choice of providers. For information about subscribership and device access, however, it relies on census data. The FCC collects data from telecommunications companies directly, but it only reflects the census block level—so if at least one home in a given census block has broadband access, federal data will show every home in that tract as having access.<sup>33</sup> The census data in turn is not accurate and leads to overcounting, due to its broad definition of broadband. While the FCC defines broadband as a 25/3 Mbps service, the census defines broadband based on technology, regardless of speed. Accordingly, the census groups internet connections provided over telephone lines, coaxial cable, and fiber optic together and calls them all "broadband." In addition, while the census asks respondents whether they have broadband, if they indicate that they do not, it provides no opportunity



for them to report on why that is—whether they have access but choose not to subscribe, whether their street has broadband but their building is not connected to it, or whether their street has no broadband access at all.<sup>34</sup> This is a critical data deficit, because it leaves policy-makers uncertain as to whether the problem lies with the utilities, the building owners, the cost of the service, or the preferences of the subscribers themselves. As a result, critics have argued that existing data consistently overstates access.<sup>35</sup>

Also, New York City does offer a variety of outreach and educational services intended to help New Yorkers gain the awareness and skills needed to make use of the internet. Programs are provided through the Mayor's Office of the Chief Technology Officer, the Department of Education, the Department of Youth and Community Development, and the New York Public Library, as well as numerous community-based organizations, and others at the State level. The confusing and crosscutting offerings reflect the lack of data about the problem.

## The technology opportunity

A variety of tools and approaches exist to realize the vision of the IMP. Ironically, perhaps, these are not so much technologically enabled innovations but approaches to delivering government services, infrastructure, and economic organization.

### Local development corporations

A key tool the City can use to implement the IMP is a Local Development Corporation (LDC). State law authorizes the City to establish corporations with the purpose of “lessening the burdens of government and acting in the public interest.”<sup>36</sup> New York City had at least 19 LDCs as of 2019, the most prominent of which is the EDC.<sup>37</sup> An LDC can operate as an arm of the municipal government and can issue its own debt, but it can also avoid some of the constraints of government, including the debt ceilings imposed on municipal governments.<sup>38</sup> The narrowness of an LDC's mandate seems to determine its acceptability to government watchdogs; the Bloomberg Administration created a Technology Development Corporation that was controversial, but many other LDCs operate with widespread acceptance.<sup>39</sup>

An LDC focused on broadband would be the natural entity to manage the City's telecom franchises, which the City Charter vests with DoITT.<sup>40</sup> These franchises yielded \$146 million in fiscal year 2021, money that currently goes into the City's general fund.<sup>41</sup> If channeled into an LDC, however, these funds could be used to cover the payments on bonds issued for the purpose of building the fiber network. This revenue could well rise over time, given that the City has worked to make more than 100,000 city assets—including street furniture, utility poles, and rooftops—available for potential wireless telecommunications siting. The pot of money could also grow if the new LDC was able to manage the City's franchise portfolio strategically, leasing space on its network to new competing service providers or even offering broadband service itself.

Conveying the authority to manage franchise agreements could be achieved via a “master contract” with DoITT, similar to the master contract agreement between Small Business Services and the EDC. Bonding authority will allow the agency to take direct action when it comes to construction, but will come with added pressure on the City to ensure proper oversight and accountability.

### Utilidors

While microtrenching offers low initial installation costs, its usefulness is limited to the duration of the street pavement itself, as road surface reconstruction all but guarantees the need to replace the conduits given their shallow depth.<sup>42</sup> However, a dedicated LDC could have the objective not just of realizing broadband access, but also improving resiliency and reducing long-term maintenance costs for other utilities. There is a longstanding need to move more of the outer boroughs' overhead utilities underground, and the installation of new underground tunnels for multiple utilities (often called “utility corridors” or “utilidors”), are a blueprint for doing so. While costly to construct, utilidors have multiple benefits: increasing reliability, reducing maintenance costs and response times to outages, and making it easier and cheaper for new utilities to be installed and for new competitors to enter the market. Cities such as Prague and Tokyo have migrated many of their municipal utilities into



A utilidor in Prague

Photo credit: Wikimedia Commons / Honza Groh.

these underground tunnels, and the City's Department of Design and Construction has been studying the concept for several years.<sup>43</sup>

Building a network of utilidors would be a prohibitively expensive task if conducted all at once, but an LDC that took a long-term view (and relied on its own funds, based in part on future revenues from those tunnels) could make it work. In 2019, the NYC Department of Transportation (DOT) issued 304,586 street opening permits, roughly half of which were for electric and telecom utilities.<sup>44</sup> If an LDC were empowered to use those cuts to install sections of tunnel wherever large-scale construction was already underway—as when DOT redesigns a street—it could, over time, create a network of utility corridors. Such a project would likely use microtrenches as part of an overall initial strategy to achieve universal broadband coverage, but would consider them a short-term fix and plan for their eventual replacement by utilidors. It is possible that new technologies, such as modern ground-penetrating radar and horizontal drilling tools used by the fossil fuel industry, can reduce construction costs as well.

Such an LDC would also need to integrate the ECS-served areas of Manhattan and the Bronx into the citywide network of fiber. Because ECS already provides many of the benefits of a utilidor system, the new LDC would likely have two objectives with

“Utilidors have multiple benefits: increasing reliability, reducing maintenance costs and response times to outages, and making it easier and cheaper for new utilities to be installed and for new competitors to enter the market.”

respect to ECS. First, it would need to ensure that its open-access fiber network did cover the entire ECS area. Second, it would need to ensure that ECS is achieving its intended objectives of providing open access and using revenues to either pay the City and/or extend its services. ECS is not currently doing these things. It has not been a source of revenue to the City (because its profits have always been reported as being below the 10% threshold which triggers revenue-sharing), and it has also failed to expand its network into more areas of Manhattan and the Bronx. Under its franchise, the City has the option to purchase ECS (for a set cost equal to the original ECS investment value plus 10 percent). The City also has the option to pursue a legal taking should they find ECS to be out of compliance with the franchise agreement. While City ownership is not necessarily the goal, an LDC focused on the creation and maintenance of a utilidor network will need to ensure that ECS is serving New Yorkers well.<sup>45</sup>

### Universal building access mandates

Access to private property has been a major challenge for competing providers, leading to higher prices and lower-quality service, thus widening the digital divide. Current legal remedies within the public service law require providers to file a petition with the state Public Service Commission (PSC) when denied access to a building. This process is slow, however, and the PSC is neither staffed to handle the high number of petitions nor does it have the power to enforce its orders, which are frequently ignored by landlords. As a result, in March 2021 the State Legislature passed

bill S5868A. Sponsored by State Senator Kevin Parker, this legislation amended the public service law in relation to facilitating access to telephone providers to deliver fiber-based services.<sup>46</sup> The bill allows providers to replace existing facilities with fiber-optic infrastructure while maintaining landlords' entitlement to compensation for such replacements under existing laws. It ensures that consumers benefit from additional competition between providers and are not blocked from accessing broadband services available in their area. At press time, the bill was awaiting the Governor's signature.

Even if this bill becomes law, however, it is not clear that it will result in universal access, because enforcement still resides with the PSC. Given that the PSC has no relationship with the City's building owners, and is not generally in the business of enforcing action at the individual building level, it is odd to delegate to that entity the adjudication of thousands of disputes relating to buildings in New York City. The City itself would be a much more logical place for such an effort, given that it does have direct interactions with all building owners, through multiple agencies—including, at a minimum, the Department of Finance (DOF) and the Department of Buildings (DOB).

The example of brownfields remediation may serve as a template for action on broadband access in the City's buildings. Until 2008, all brownfield remediations in New York City had to be overseen by the New York State Department of Environmental Conservation (DEC). DEC's brownfield processes were tailored to large, heavily polluted sites, where cleanup takes years. But officials recognized that the vast majority of polluted sites in the state were in New York City, and the vast majority of these—thousands of locations—were small sites with relatively low levels of contamination, such as former dry cleaners, scattered across the five boroughs. Further, the City had a strong interest in seeing those sites remediated for economic development reasons, which was not a driver of DEC action. To address this, the City and State agreed to a process by which New York City obtained “delegated authority” to oversee low-level brownfield remediations, and created a small, dedicated office called the Mayor's Office of Environmental Remediation (OER)

“New York City has routinely struggled to obtain detailed data from telecommunications providers about internet access and the location of existing fiber.”

in 2009. Within a few years, OER had been able to help thousands of sites get cleaned up and certified for redevelopment.<sup>47</sup>

It is possible that the City could play a direct role in mediating disputes between building managers and telecoms seeking to expand internet service. The authority to do so could be derived from a local law that requires access to be granted unless extenuating circumstances exist; while this would duplicate State law, a local law would allow the City to intervene and adjudicate disputes. Such a role could be given to an existing agency that oversees buildings—such as DOF or DOB—or to an entity with a policy objective related to the digital divide, such as DoITT or the CTO.

There has already been interest at the City Council in mandating the provision of internet access. In 2020, Councilmember Ben Kallos introduced legislation that would require that all new construction and renovation be wired for internet, and that landlords include internet access in the rent. While the bill was not enacted (and Kallos was term-limited out in 2020), the idea of City Council legislation to consider internet wiring and service as a necessary component of livable housing now has precedent.

### Data-gathering from buildings

Across the United States, accurately measuring broadband access has proven problematic. While the City mandates that residential building managers turn over lots of information—covering everything from window guards to energy consumption to profitability for buildings with rent-stabilized units—all data about

whether a building has access to the internet is held by the building itself and the providers in the neighborhood, which are often reluctant to share.

While federal and State efforts to improve data-gathering about broadband access are ongoing,<sup>48</sup> New York City has routinely struggled to obtain detailed data from telecommunications providers about internet access and the location of existing fiber.<sup>49</sup> Yet the City has mandated many other types of data collection from building owners and managers. For example, the City's health code requires that landlords and building managers solicit data from tenants about the presence of window guards.<sup>50</sup> Local laws mandate that building owners submit detailed energy consumption data through an annual form to the DOB.<sup>51</sup> Every three years, the Department of Housing Preservation and Development conducts the Housing and Vacancy Survey to gather detailed data on the city's housing market.<sup>52</sup> There are a variety of ways that the City could work with building owners and managers to collect data on whether their building has access to broadband, which providers are available to them, and their past experiences seeking a connection to broadband or being approached by telecommunications companies offering these connections.

### Public Engagement Unit

In 2015, the de Blasio Administration initiated an effort that may point the way to a more targeted and structured approach to reach the relatively small proportion of New Yorkers who are unaware of the value of the internet, or who struggle to use it. This was the creation of the NYC Public Engagement Unit (PEU), which brings the outreach tactics and spirit of campaign organizing to City government. PEU contacts New Yorkers by phone, at home, and increasingly, through digital channels like peer-to-peer texts, with the aim of actively helping them access healthcare, procure municipal ID cards, and participate in other City programs. The PEU teams provide residents support in their interactions with government agencies in housing, health, and other critical service areas. As a crosscutting resource spanning the city's many individual departments, PEU is, like 311, a rare example of a simple interface (in this case, a conversation) designed to help residents to connect with their government.

This combination of outbound, multichannel, highly targeted outreach could be a more useful way to improve access for the New Yorkers who have the least access to or familiarity with the internet. Such outreach is also increasingly necessary as the City itself relies more on digital technology to interact with New Yorkers. The risk is that the more integrated—and better—the City's digital services become, the greater the gap will be for those New Yorkers who cannot, or prefer not to, engage digitally.<sup>53</sup>

## An agenda for the next administration

The IMP lays out an ambitious vision for universal broadband access, but realizing that vision will be the responsibility of the next Mayor, City Council, and Comptroller. Further, the question of building access was left out of the IMP and should be addressed. We recommend the following steps.

### 1 Establish a Broadband Development Corporation (BDC) tasked with the creation of a citywide open-access fiber network and utility corridor network

The City Council should pass legislation creating a Broadband Development Corporation (BDC) and assigning it the task of developing a citywide, publicly owned network of open-access infrastructure consisting of utility corridors, tunnels, trenches, conduit, and locations for wireless equipment. Further, it should require the City to enter into an agreement by which the BDC will manage all franchises related to telecommunications within the city, on behalf of DoITT. By doing so, the Council would address three critical challenges that previous governmental efforts have faced: independent bonding authority, clarity and continuity of agency responsibility, and the ability to enforce franchise agreements through network ownership.

## 2 Assert a City role in ensuring building access

As noted above, the City is much better positioned to address the challenge of resolving disputes between building managers and telecom providers around building access. To do this, the City Council should enact legislation creating a legal, City-mandated framework that would provide telecom networks with reasonable access to public and private rights-of-way and buildings, to allow network creation for each building in the City by multiple providers. The same legislation should also essentially duplicate existing state and federal law prohibiting building owners and managers from favoring one provider over another, or seeking or accepting payments; by doing so, it would establish a role for the City in enforcing these existing laws. It should also protect the rights of building owners to have the network providers cover all the costs of installation, including repairing damage incurred during installation, and establish a City agency to manage this process, receive complaints from either network providers or building owners, and adjudicate disputes. While DOB or DOF could play this role, we recommend that the new BDC manages this process, with the adjudication of disputes going through existing DOF or DOB processes.

## 3 Ensure the BDC can coordinate the activities of other city agencies

Constructing a citywide conduit network will require the coordination of many City departments, as it is essentially a complicated long-term capital plan. Both the Bloomberg and de Blasio administrations established broadband working groups to corral external partners, but the creation of the broadband network envisioned in the IMP and a utility corridor network will require significant coordination of many City agencies. These include:

- The Department of Transportation, which controls access to lamp posts, traffic signals, and other street furniture necessary for the mounting of wireless communications equipment

- The Department of Buildings, which controls and permits the installation of such equipment in buildings
- The Fire Department, which has both a permitting role and is constructing its own fiber network
- The Department of Environmental Protection, whose water lines and sewer systems often dictate the shape, scope, and cost of new underground infrastructure

Ensuring this level of coordination likely requires that the BDC report directly to the Deputy Mayor of Technology recommended in Chapter 1.2, Administration.

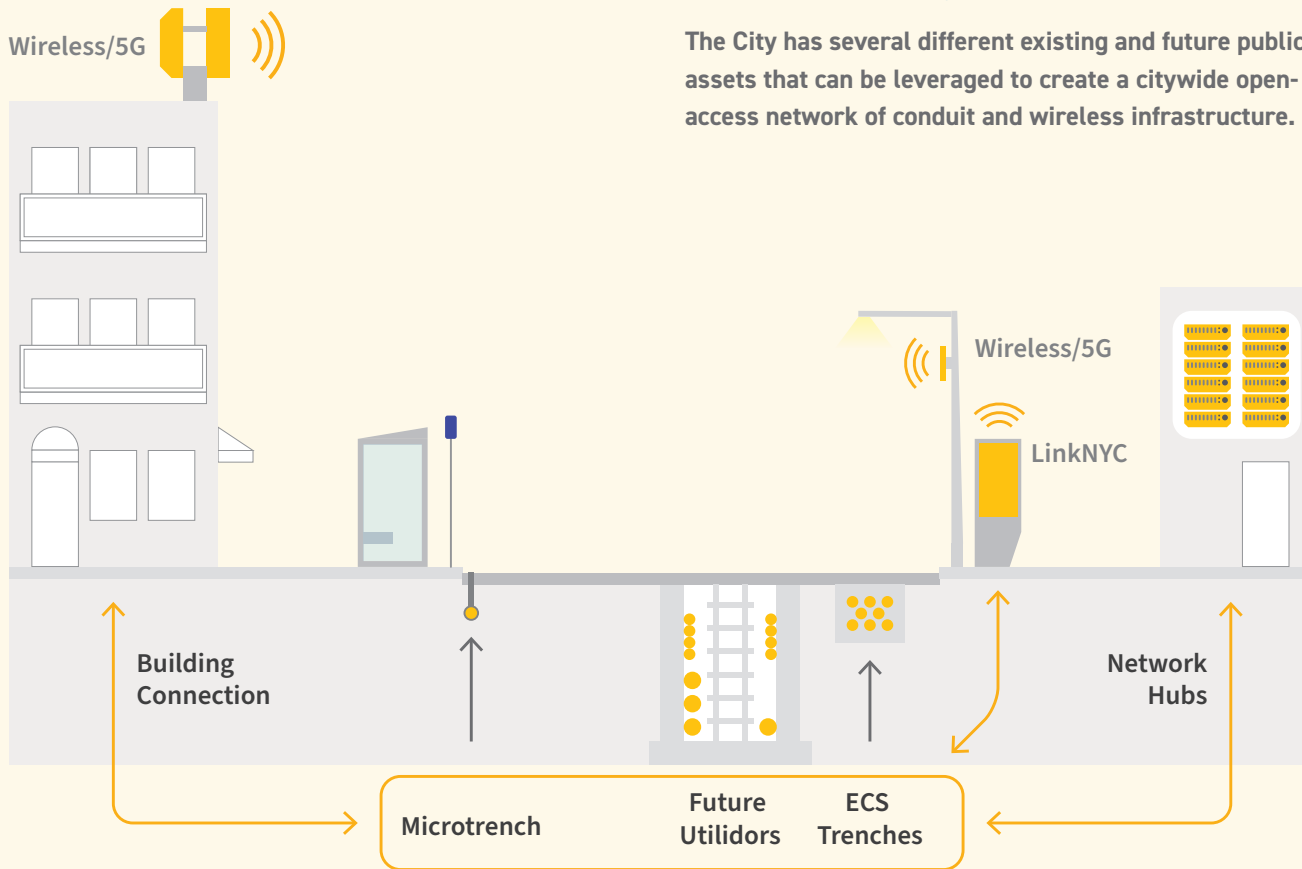
## 4 Ensure that the Empire City Subway is executing its franchise in the best interests of the City

Given the importance of the ECS to connectivity and the concerns about its current performance, the BDC will need to exercise its oversight over ECS aggressively to ensure that it is meeting its open access mandate, raising revenue, and using those funds to expand its network.

To that end, we recommend that the incoming Comptroller undertake another detailed audit of ECS, updating the 2010 audit with more recent information that can guide the BDC's policy and serve as the basis for legal action in the event that ECS is again found to not be meeting its commitments. The City may wish to acquire ECS regardless of the audit's findings in order to integrate the system into a citywide utilidor network, or to re-bid out the contract under new terms.

## Cross-section of city infrastructure

The City has several different existing and future public assets that can be leveraged to create a citywide open-access network of conduit and wireless infrastructure.



### 5 Institute two approaches to gather data on broadband access: annual reporting from building owners, and inclusion of broadband questions in the Housing and Vacancy Survey

Foundational to the IMP is the recognition that broadband access in the 2020s is a necessity for daily life, making it more like water and electrical systems than like cable television. Given broadband's importance and the difficulty of gathering data on it, the City should institutionalize systematic, ongoing approaches to gathering the data. This should take two forms. First, the City Council should enact a law requiring that building owners and managers annually report whether their building has broadband access, which companies provide it, and whether they have sought or been solicited for a connection. Second, the Department of Housing Preservation and Development

should include three questions about broadband in the next Housing and Vacancy Survey (to be administered in 2023) to understand whether a respondent has broadband, whether the respondent's residential location offers broadband, and, if the respondent does not have broadband but has access to it, why they have chosen not to subscribe. Taken together, these two data sources will enable an ongoing, detailed, and reliable assessment of broadband access challenges and their causes.

### 6 Use the Public Engagement Unit to address digital inclusion in a strategic, data-based way

The PEU's approach of targeted outreach tailored to the individual's preferred means of communication is the correct basis for a strategic approach to addressing those New Yorkers who are most distanced from the

internet and digital technology. We recommend that the PEU be deployed in a thoughtful and strategic way to address these New Yorkers.

Such an effort would start with data collection, including that described in the previous recommendation. In addition, it will require a long series of interviews and data-gathering at the neighborhood level, targeting the populations that emerge as those most in need. Then, we recommend that PEU, perhaps in conjunction with one or two agencies that are currently providing training, map out a strategy not only around what these New Yorkers need, but also around how to reach them in a systematic way. Subsequently, PEU will need to conduct an assessment of all digital training currently being provided by the City. It may be that some existing programs can be merged or streamlined, while others will need to expand. But with a strategic, data-based approach, it is likely that digital inclusion will be addressed with greater effectiveness and with lower cost.

Based on our interviews, we foresee the need for three main resource categories. The first is focused on digital literacy efforts designed for people with no prior skills, conducted through outreach and education at locations such as senior centers. The second is aimed at people who need subsidies in the form of free or low-cost plans and devices. The third should simply ensure that the design of online city services always follow a “mobile first” approach.

PEU’s location within the Human Resources Administration (HRA) has to date limited its scope and utilization. The City should move PEU from the HRA to be overseen by a Deputy Mayor for Technology, as recommended in Chapter 1.2, Administration, and integrate its activities with 311 and nyc.gov.

## Privacy and equity concerns

We have identified no privacy concerns with these recommendations. The data being sought about building broadband connections does not encompass personally identifying information, and the Housing and Vacancy Survey operates under an existing privacy and aggregation approach that has not raised concerns to date.

The overall objective of this set of recommendations is the pursuit of equity. It is possible that the proposed BDC could undermine an equity objective by focusing, for example, on lowering costs in neighborhoods that already have good broadband access while neglecting the expansion of service to locations without any broadband at all. It will be necessary for the entity to ensure that it is promoting affordable access to all New Yorkers as its primary objective and prioritizing its work accordingly. Further, embracing the long-term objective of undergrounding utilities outside of Manhattan will have clear equity benefits, given the average income levels of Manhattan residents and those in the outer boroughs.

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### **3 Optimize systems: Use technology to improve the management of our built environment**

One of the hallmarks of local government is that while the federal government is mainly a policy-making entity, municipalities are mainly service providers. When we turn on the faucet or cross the street, when we send our kids to school or when we take out the trash, we are relying on New York City to do its job effectively, efficiently, and equitably.

We have found that technology offers the potential to improve many of these services dramatically. These tech solutions include data-gathering systems, new ways for City agencies to share data, and new standards for the City to demand of the private sector. In some cases, these innovations require New Yorkers to accept new ways of conducting business; in others, they require City agencies to redesign their rules and processes to capture the benefits that technology offers.

These solutions are only a beginning, but they demonstrate that when applied well, urban technology offers a path to a safer, more enjoyable, more affordable, and more equitable city.

## 3.1 Bring safety and order to our streets through digital management and enforcement

As anyone who has ever tried to cross an avenue or park a car in the City knows, New York's streets are chaotic, dangerous, and congested. A key reason for this is that we can't—or won't—enforce traffic laws and manage parking thoroughly. But cameras and digital tools can make it possible to reserve parking spaces, eliminate double-parking, and enforce traffic laws consistently.

### The problem we face

Streets make up 27% of New York City's land area, and are the one space that all New Yorkers use together, every day. Even before the pandemic, it was increasingly clear that our streets need major changes, and that need has only become more urgent as a result of COVID-19.

At its root, the problem on our streets is one of coordination: ensuring that everyone who uses these shared spaces does so in a way that allows everyone else to use the space appropriately as well. This involves both allocation—who should be in what space—and enforcement, to make sure that everyone is following the rules and acting safely.

The unfortunate reality is that New York City is terrible at coordinating how people use its streets. This failure manifests itself in three ways.

The first and most fundamental is that New York City's streets are not safe, largely because drivers do not obey traffic rules. Some 240 people died on our streets due to traffic crashes in 2020. This total includes 86 pedes-

trians, 26 cyclists, and 128 motorists. But deaths don't tell the entire story of safety: there were also 44,400 injuries due to crashes, which included 32,173 motorists, 6,677 pedestrians, and 5,550 cyclists.<sup>1</sup>

The overwhelming majority of these crashes were caused by bad driving. "Driver inattention/distraction" was the leading factor cited, followed by "Failure to yield," "Following too closely," "Unsafe speed," and "Traffic Control disregarded." Only 838 of the 33,211 crashes with injuries—less than 3%—were attributed to errors on the part of a cyclist or pedestrian. Ironically, the pandemic reminded us that New York City's chronic traffic congestion has a safety benefit because it reduces speeding. When traffic volumes declined, speeding rose, making 2020 an unusually deadly year on the City's streets, especially for motorists. In pre-pandemic years, more pedestrians and cyclists have been killed by vehicles on New York City's streets than motorists.<sup>2</sup>

The second way our failure to manage the streets shows up is in overweight trucks. While dangerous driving makes streets perilous for people, overweight vehicles cause damage to the roads themselves. The impact of trucks on bridges and viaducts increases dramatically as the weight of each vehicle goes up, and trucks that weigh too much are a major source of wear to New York City's roadways. Across the United States, trucks are limited to 80,000 pounds, while several New York City roadways, such as the Brooklyn Bridge, have much lower weight limits. However, a recent sampling undertaken on the at-risk triple cantilever of the Brooklyn-Queens Expressway through Brooklyn

“There’s one underlying reason we don’t enforce and manage our streets well: using traditional methods, it’s basically impossible.”

Heights indicated that more than 10% of all trucks were overweight, with some weighing as much as double the legal maximum.<sup>3</sup>

The third place we see the City’s street management fall short is at the curb. By definition, every vehicle trip starts and ends the same way: pulling up to park, or trying to do so. Further, the demands on the curb have only grown. The pandemic has led to what was probably a doubling of deliveries in residential neighborhoods while at the same time the rise of ride-hailing has nearly doubled the total number of pick-ups and drop-offs that take place in New York City, with far greater growth in the outer boroughs than in Manhattan. Unlike the yellow-taxi trips they have partially displaced, ride-hail trips usually begin with a car waiting mid-block for a number of minutes for a passenger to emerge from a building, rather than fast pick-up resulting from a street hail.<sup>4</sup>

The problem is that as demand for the curb has increased, the supply is, of course, fixed. Even the broadest boulevard has only two sides. This is why so many New York City trips lead to double-parking. And that’s a problem for all New Yorkers, because it exacerbates increasingly unsafe conditions on the roads and backs up traffic.

These problems are multifaceted, but there’s one underlying reason we don’t enforce and manage our streets well: using traditional methods, it’s basically impossible. In the case of a moving violation, by definition, the violator is moving. The traditional enforcement approach requires chasing a car and stopping it—a difficult and dangerous step for a police officer to take in a crowded city street. Unsurprisingly, it is undertaken only rarely.<sup>5</sup> As for overweight vehicles, a traffic officer can’t just look at a truck and determine how heavy it is; on highways, it’s possible to make trucks

stop at weigh stations to check their weight, but there are no weigh stations in New York City. Enforcing parking violations, meanwhile, is hugely labor-intensive; there are roughly 3 million parking spaces across the City, so patrolling even a fraction of them regularly would require a force many times greater than the 2,800 traffic enforcement agents (TEAs) the City currently employs.<sup>6</sup>

Even significant “blitzes” focused on enforcing traffic regulations with traditional means have little impact. And evidence clearly suggests that police target minorities unfairly when enforcing traffic laws. Traffic stops are the most frequent source of police interactions for people of color—often, unfortunately, with deadly consequences.<sup>7</sup>

Managing the curb is even more difficult. Matching supply to demand requires work. Private parking garages often employ valets to ensure space is used optimally. Restaurants take reservations to ensure that guests can rely on a table being available when they need it. Doing either of these for the city’s street parking is clearly impossible due to the amount of labor it would require. As a result, we rely on a coarse set of parking rules and then use a first-come-first-served system. This, however, means that we lose precision. No one—no matter how urgent or predictable their need for curb space—can rely on finding a parking spot when they need it.

## The technology opportunity

Digital technology can make a huge difference to our streets because it is excellent at the tasks involved in managing streets and curbs: matching supply to demand, keeping track of reservations, observing behavior, and identifying violators.

New York City has already made tremendous strides towards using cameras to enforce driving rules, although there is plenty of opportunity to do more. Beginning in 1998, the City has used red light cameras, first in a pilot program and then expanding to include 150 cameras—still only about 1 out of every 83 intersections across the city.<sup>8</sup> In 2014, the City was able to install its first speed cameras, a program that has now been expanded to include 750 zones (areas within a



An enforcement camera on Fifth Avenue in Manhattan. New York City has the largest network of enforcement cameras in the world, but cameras can be used to enforce a variety of other traffic violations.

Photo Credit: Ben Oldenburg.

quarter-mile of a school) and a total of 2,000 cameras. At the moment, the cameras are only operational between the hours of 6 a.m. and 10 p.m.<sup>9</sup> The City is also now using cameras to enforce dedicated bus lanes. The new “NYC Streets Plan” from NYC DOT recognizes the importance of automated enforcement, and advances the idea of dramatically expanding the use of cameras to issue tickets for everything from parking in bike lanes to making illegal turns.<sup>10</sup>

The programs have been a resounding success. The City’s red light cameras have produced significant benefits, issuing an average of 5 tickets per day per intersection with a camera, and generating over time an 83% reduction in the number of red light violations.<sup>11</sup> The speeding cameras have similarly demonstrated how digital enforcement is much more effective than human enforcement of moving violations. In 2012, the NYPD issued 71,000 speeding tickets; in 2019, as part of Mayor de Blasio’s Vision Zero effort to reduce traffic-related fatalities, that number doubled to nearly 150,000. By contrast, in 2019, the City’s speed cameras across only 750 zones issued a total 2.3 million violations—a remarkable testament to the amount of law-breaking that traditional enforcement methods

were unable to address. Further, only 0.1%—one out of every thousand—speeding camera tickets have been dismissed by a court.<sup>12</sup>

While New York City has implemented camera-based enforcement of moving violations more than any other American city, many global cities deploy this technology for additional functions. Since 2005, London has been using an extensive network of cameras to issue remote citations for a wide range of moving violations, including stopping in no-stopping zones on major streets (“red routes”), stopping in an intersection (what New Yorkers call “blocking the box”), and driving in bus lanes.<sup>13</sup> These efforts began with video cameras whose footage was reviewed by traffic enforcement agents, but have over time been digitized. As in New York today, the vast majority of all red light and speeding violations are based on camera enforcement, rather than in-person enforcement.<sup>14</sup> In at least some parts of London, all enforcement of non-criminal moving violations (such as illegal turns and lane changes) is conducted via cameras.<sup>15</sup> Several cities in Europe and Asia have relied on camera-based enforcement since the 1960s.<sup>16</sup>

Similarly, cameras combined with scales embedded in the pavement can weigh trucks while they are driving at highway speeds and then photograph the trucks and their license plates.<sup>17</sup> In Europe, Hungary implemented a national system of automatic truck weight enforcement on its roads in 2018, using technology from a Swiss company, Kistler.<sup>18</sup> The state of Indiana has been using cameras and scales provided by Kapsch, a traffic technology company, in a pilot.<sup>19</sup> Already being piloted in several states, this technology has been proposed for a pilot on the Brooklyn-Queens Expressway in a bill introduced in the New York State Senate by State Senator Brian Kavanagh.<sup>20</sup> At press time, this bill had passed both houses of the Legislature and was awaiting the Governor's signature.

Cameras can also be used effectively to enforce parking. By mounting cameras on City vehicles—whether dedicated traffic enforcement vehicles, police cruisers, or even garbage trucks—parking violations can be enforced much more frequently. Fort Lauderdale, Florida, was an early adopter of mobile automated license-plate recognition (ALPR) technology, mounting ALPR cameras on parking enforcement vehicles. Using only a limited number of ALPR-equipped vehicles, the city was able to increase the number of tickets issued to illegally parked vehicles by a factor of 14, while also integrating a variety of parking permits and pay-by-plate systems. With the expanded enforcement, the city saw an increase in parking receipts and compliance, and the fees paid for the system in two months.<sup>21</sup> Closer to home, in Scarsdale, New York, village officials implemented a mobile ALPR system for parking enforcement in 2018. An immediate finding was that several vehicle owners had illegally borrowed or photocopied commuter parking placards that did not match their license plates. Within two weeks, this phenomenon ended, indicating that enforcement led people to stop placard abuse.<sup>22</sup>

New York City has been slow to adopt digital technology for parking enforcement. It moved away from traditional parking meters with the switch to the Muni Meter (piloted in 1999, with citywide deployment by 2009), and embraced pay-by-phone for parking through the ParkNYC app, a partnership begun in 2016 with the company ParkMobile.<sup>23</sup> However, the

NYPD uses mobile automatic license plate recognition software for surveillance, but not for parking enforcement.<sup>24</sup>

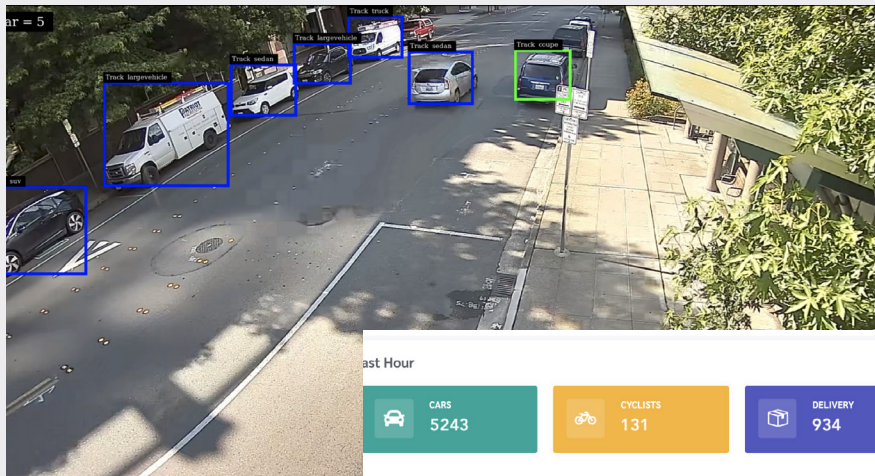
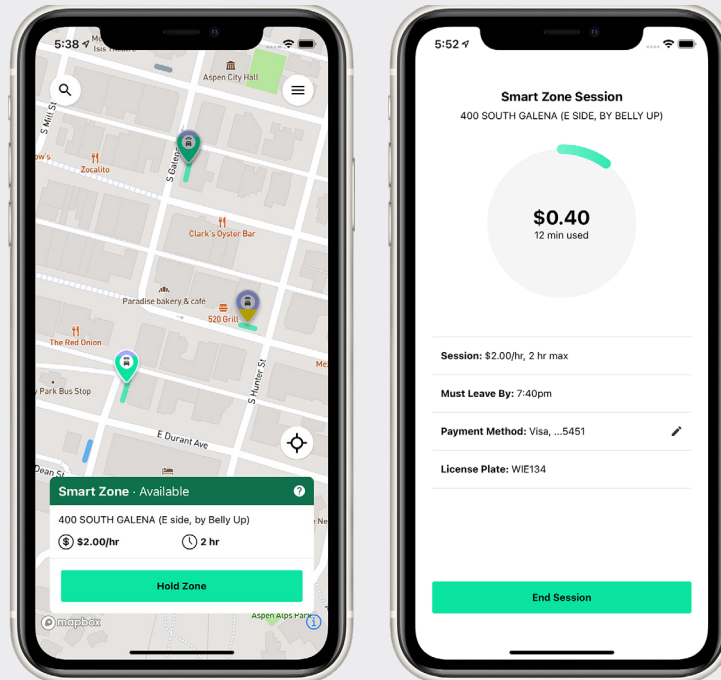
Camera-based enforcement offers three main benefits.

The first is that pervasive enforcement is far more effective at deterring violations than sporadic enforcement. With New York City's speeding cameras, fully 59% of all drivers who have ever received a speeding ticket from a camera did not get another one, and another 18% only got one more. This suggests that the system quickly led three-quarters of all drivers to permanently change their behavior. This led to direct safety improvements: within four months of the installation of a camera, there was on average a 66% reduction of speeding at that intersection.<sup>25</sup>

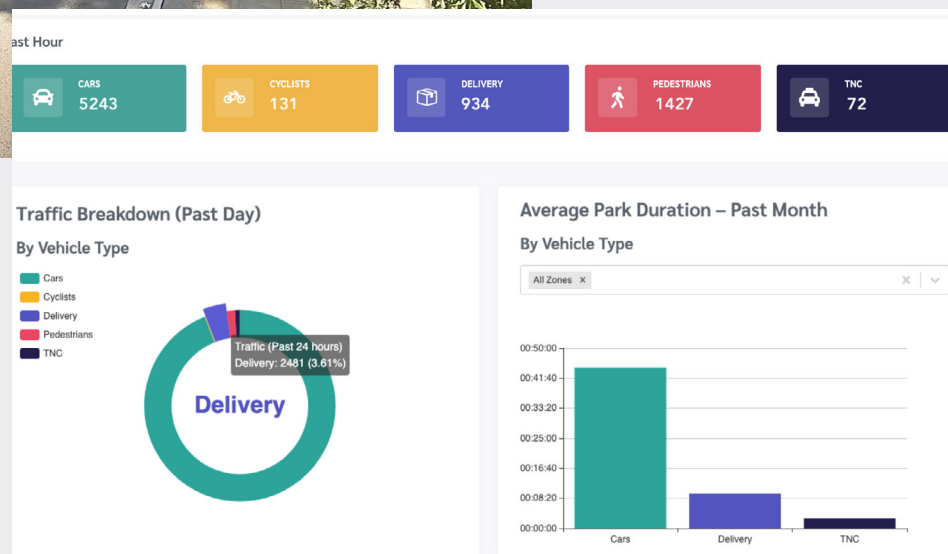
The second is that camera-based enforcement reduces the potential for bias or favoritism in the application of the law. Evidence suggests that police nationwide disproportionately target minorities in enforcing traffic laws, and New York City is no exception.<sup>26</sup> By reducing the discretion involved in which violators to ticket, automated systems eliminate this source of bias, whether conscious or unconscious. Similarly, the City has issued 125,000 parking placards to City employees, including police and teachers, granting them exemptions from parking rules in certain circumstances and for certain official purposes. Advocates have long argued that these are widely abused, that fake permits are created without authorization, and that NYPD officers are reluctant to issue tickets to anyone who appears to be affiliated with law enforcement.<sup>27</sup> With an automated, camera-based system, it is far more likely that the laws will be applied equally.

Finally, traffic stops are increasingly identified not only as a source of unfair policing of certain groups, but moments when there is a high likelihood of violence. New York State Attorney General (AG) Letitia James concluded that the NYPD should no longer enforce non-criminal traffic violations because such traffic stops tended to escalate into disproportionate violence, with a particularly negative effect on people of color.<sup>28</sup> This recommendation was underscored in James's investigation into the 2019 death of Allan Feliz, a driver who was stopped in the Bronx by an officer for not wearing a seat belt; the traffic stop

Coord's pilot in Aspen, Colorado, allows drivers to see the availability of specific drop-off parking spots, and to reserve and pay for them, through an app. Image credit: Coord.



Automotus uses computer vision technology to monitor and enforce curb usage. Image credit: Automotus.



resulted in the officer shooting and killing Feliz. While the investigation did not find the officer's action to be criminal, because he believed he was using deadly force to protect his partner from Feliz, the AG's report concluded that he was mistaken. Essentially, the stop itself created an unsafe situation that was out of proportion to the violation.<sup>29</sup> The fear that drivers might become violent when stopped for traffic violations, however, is not unfounded: 100 TEAs are assaulted each year. One reason that traffic enforcement was turned over to the NYPD was that in the 1990s, when TEAs were part of NYC DOT, approximately 600 TEAs were attacked by angry drivers annually.<sup>30</sup>

While a pervasive, fine-based system could have disproportionately negative impacts on low-income drivers, recent legislation helps ameliorate this impact. New York State recently enacted the Driver's License Suspension Reform Act, which replaced the practice of suspending someone's license for unpaid tickets and allowing the creation of a payment plan capped at 2% of the individual's monthly income.<sup>31</sup> While the law does not lower the total fines, it does help ensure that accumulated tickets will not lead to the catastrophic impacts of being subject to arrest or being unable to drive to a job.

Camera-based enforcement, however, is not the only way that technology can help bring greater safety and predictability to the City's streets.

Digital technology can also be used to create a reservation system for parking, which would allow New Yorkers to identify where they need a space, for how long, and gain certainty and predictability as to its availability when they need it. This is especially important for loading zones, deliveries, and for-hire car services, which would otherwise be likely to double-park, impeding the flow of traffic and creating dangerous conditions, especially for cyclists. A system like this would function similarly to the reservation systems that serve restaurants, such as OpenTable.

Although not widespread, several such systems are being offered by companies and piloted around the United States. The multiplicity of players in this field could make it possible for cities to avoid being locked into dependence on a single vendor. Washington,

“Technology can actually prevent drivers from making mistakes, not just catch them doing so.”

D.C., tested a system provided by a company called CurbFlow, through which drivers could join a program that would give them access to reservations for short-term parking, mainly intended for pick-ups and drop-offs, and targeted especially at delivery drivers.<sup>32</sup> Aspen, Colorado, piloted a system offered by New York City-based Coord in 2020, which was considered successful: 28 fleets of delivery vehicles participated (including both national and local fleets) and reported high levels of satisfaction among users. The initial results of the pilot indicated that 40% of drivers using the loading zones reserved their space in advance.<sup>33</sup> Santa Monica, California, is undertaking a similar pilot with a Los Angeles-based company, Automotus.<sup>34</sup>

Finally, technology can actually prevent drivers from making mistakes, not just catch them doing so. Mapping and camera technology in existence today means that virtually every vehicle can automatically obtain the correct speed limit for the road it is on. With this information, an alarm can sound alerting the driver every time the car is exceeding the speed limit. Further, it is a simple task to add a speed regulator to a vehicle either to prevent it from exceeding the speed limit or some preset figure above the speed limit. A wide variety of after-market retrofit solutions exist, many developed as a solution to allow parents to limit the speeds of teenage drivers.<sup>35</sup>

Although such technology is not yet widespread, it will likely become more common. The European Union has announced that such equipment will be a mandatory safety feature on all new cars sold in the EU after May 2022.<sup>36</sup> Despite Brexit, the United Kingdom has announced it will maintain the new mandate as well, citing its safety benefits.<sup>37</sup> US DOT proposed requiring such technology on heavy trucks in 2016; although the rulemaking was stopped by the Trump Administration, an effort to revive it now has the endorsement of the American Trucking Association.<sup>38</sup> In New York, Revel



mopeds use similar technology to govern their usage in parks and other areas.<sup>39</sup> Adopting such technologies in vehicles would switch technology from an enforcement role—of punishing bad behavior—to the more positive function of not allowing drivers to violate the law in the first place.

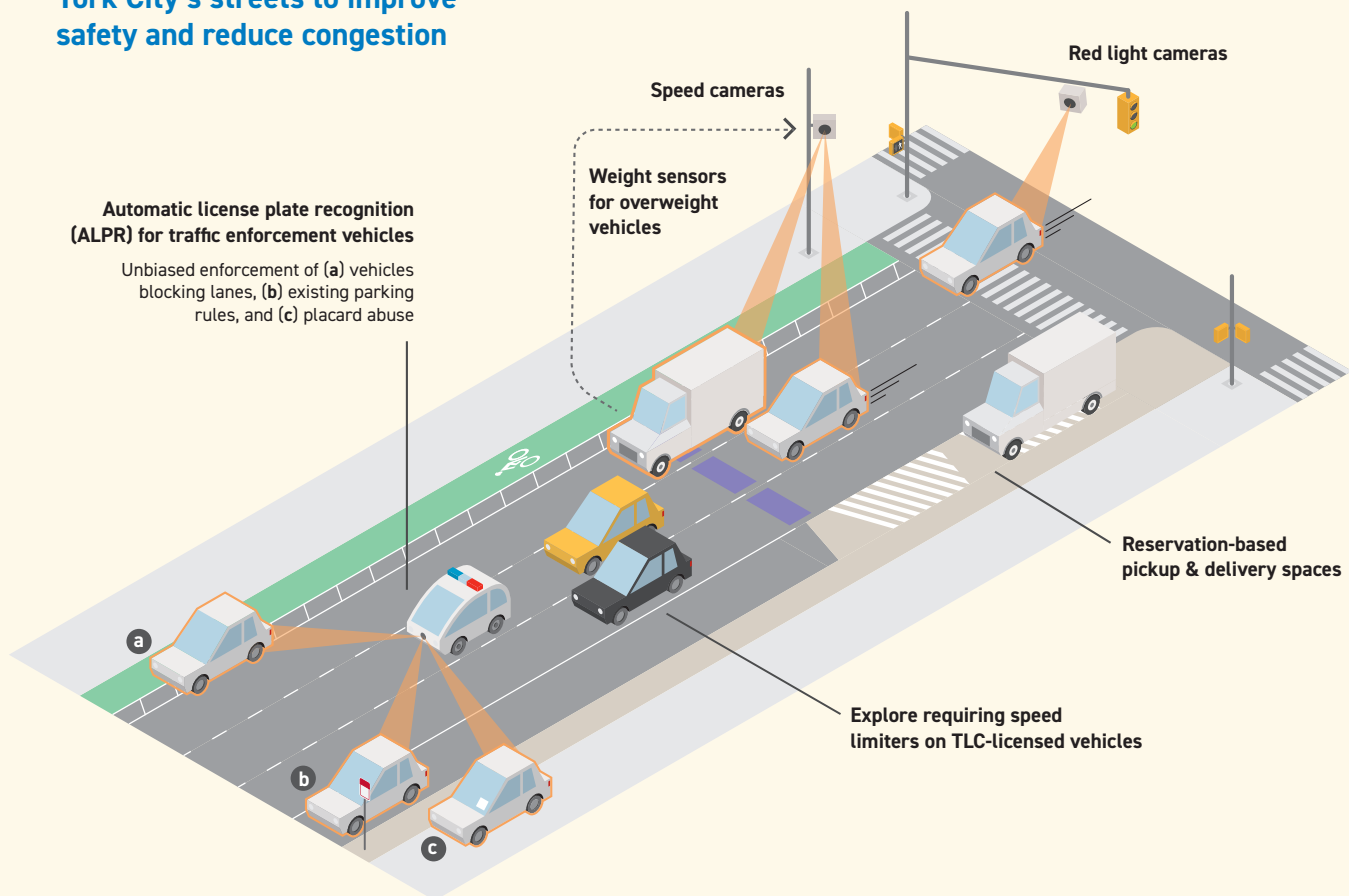
# 1 Build out a complete network of enforcement cameras immediately and use them to the fullest extent of City authority

## An agenda for the next administration

Bringing safety and order to New York City’s streets will require aggressive leadership from the Mayor, as well as support from the City Council.

The City need not wait until it has full authority from the State to begin moving towards partial implementation of cameras for moving violations. In addition to the speed and red light cameras already authorized by the State, the City also has the ability to use cameras to monitor traffic, and to enforce violations committed by drivers who are licensed by the Taxi & Limousine Commission. It should make full use of these powers. Doing so would require the following steps:

### Digital tools can manage New York City’s streets to improve safety and reduce congestion



### **A. Fully implement speed and red light cameras to the extent authorized by law**

It was the stated intention of DOT to implement the authorized limit of 2,000 cameras in the City's 750 school zones before the new Mayor came into office, but if implementation fell short of that goal, it should be the top priority of the incoming Commissioner of Transportation to fully execute the current limits.

### **B. Begin to use cameras to track additional violations such as double-parking, blocking the box, overweight/overlong trucks, and aggressive turns**

Even without state authorization, the City can use cameras to gather data on the way its streets are functioning. It would make sense to implement a program to procure and install cameras equipped to enforce against other violations (and it may be that existing cameras can do some of these tasks with only a software upgrade). This proposal has two benefits: first, it would provide data that would justify the expanded use of camera enforcement; second, it would ensure that minimal time is lost between state authorization, whenever it comes, and the implementation of the system. The first step in this process would be to issue an RFP to qualified vendors for demonstration equipment, which should be feasible by June 1, 2022.

### **C. Use this expanded set of cameras and capabilities to enforce against NYC TLC-licensed vehicles**

A large portion of the vehicles on New York City's streets—110,000 to be exact—are taxis and for-hire vehicles licensed by the TLC.<sup>40</sup> While the City requires State authorization to ticket private drivers using a camera, TLC-licensed drivers are also subject to TLC-specific fines for violations of TLC rules, which include following traffic laws.<sup>41</sup> This means that even when the State does not allow cameras to be used to enforce against private drivers, the City has the power to use cameras to monitor the driving behavior of these drivers. TLC already adds fines and points to drivers' records for some types of traffic violations, including camera-based tickets.<sup>42</sup> Using this power in conjunction with an expanded, more capable camera network would give it purpose even prior to State authorization for more general ticketing. The first step in this process would be to initiate a TLC rulemaking, which should

begin at about the same time as an RFP is issued as described above, so that the rulemaking is completed by the time the first cameras are installed or existing cameras' capabilities are expanded.

### **D. Implement pay-by-plate for parking enforced by automated license plate readers**

In early 2019, Mayor de Blasio announced that NYC DOT would shift to a "pay-by-plate" system in which a vehicle's license plate, not a receipt on the windshield, would determine whether vehicles were parking legally. One of the stated objectives of that move was to reduce placard abuse and remove discretion from officers as to what vehicles to ticket. Thus far, it seems that DOT has not significantly advanced that effort.<sup>43</sup>

The incoming administration should move aggressively toward a pay-by-plate system, and embrace vehicle-based and fixed cameras for enforcement. A wide range of vehicles—MTA buses, school buses, DSNY street sweepers, TLC vehicles, official City cars, and others—could all become part of a mobile enforcement fleet simply by mounting cameras on them. At the same time, it is likely that fixed cameras will also be needed to ensure full coverage, especially to address the problem of occlusion that prevents license plate reading when cars are parked close together.

The first step in this is likely to be a pilot program, which would begin with an RFP. Given that several other cities already use pay-by-plate and ALPR enforcement, DOT should be able to model an RFP on the work that other cities have already done.

Overall, the enforcement systems proposed here are likely to have meaningful capital costs, but will pay for themselves very quickly through near-term fine revenue. The City's entire speed camera program expended \$60 million in capital costs and \$105 million in operating costs between 2014 and 2019, but generated \$254 million in revenues.<sup>44</sup> The City's red-light camera program has had similar results.<sup>45</sup> ALPR-based parking enforcement programs elsewhere have shown that they recover their capital investments in months or weeks, rather than years.<sup>46</sup>

## E. Integrate automated violation data into the City's street design and maintenance program

In addition to enforcement, street design can play a major role in preventing bad driving behavior and minimizing the likelihood of injuries if there is a crash. However, because only a very small percentage of dangerous behavior results in a crash, basing crash predictions solely on prior crash locations will fail to capture many locations where a redesign might be appropriate. More complete data on where drivers are violating traffic laws could also be used to prompt a redesign of those streets or intersections. This could be implemented through DOT policy and practice, but it would also be appropriate for the City Council to require a report on where dangerous driving is concentrated and whether redesigning those locations could improve safety.

## 2 Obtain State legislative authority to use technology to enforce all traffic violations

Ultimately, however, the City requires the authorization of the New York State Legislature to implement camera-based enforcement, because it is the legislature that defines what is required to issue a violation—and, in most cases, the law as currently written requires an in-person witness, a stop by an officer, and a ticket handed to the driver. This has long been a sticking point: the City has sought permission from the Legislature for various types of camera enforcement since the 1990s, only to be rebuffed at first and then limited to small programs.<sup>47</sup> In 2013, the legislature approved a five-year pilot allowing the City to use speed cameras only in school zones and during school hours, which proved highly effective.<sup>48</sup> In 2019, a delay due to Republican State Senators holding the issue hostage allowed the program to lapse. The Legislature then passed S. 4331/A. 6449, sponsored by Senator Andrew Gounardes and Assemblymember Deborah Glick, allowing the City much greater latitude in installing cameras and increasing the number, but still restricting camera operation to certain hours and within one-quarter mile of a school.<sup>49</sup> In December 2020, Mayor de Blasio initiated an effort to get the Legislature to allow the City to operate the cameras 24 hours a day, citing the

fact that an increasing proportion of speeding incidents and speeding-related crashes take place at night, when the current law does not allow the cameras to operate.<sup>50</sup> In the summer of 2020, State Senator Brian Kavanagh introduced a bill to allow the City to undertake camera-based truck weight enforcement only on the BQE in Brooklyn as a demonstration project.<sup>51</sup> At press time, it had passed both houses of the Legislature and awaited the Governor's signature.

The tortured history of using technology to enforce traffic laws in New York City suggests that the priority for a new Mayor and City Council should be to seek blanket authority to enforce moving and parking violations on New York City streets through camera enforcement. NYC DOT has had tremendous success in implementing these programs, proving that Albany's oversight is unnecessary. New York City need not be micromanaged by Albany on the way it ensures the safety of its streets. Governor Kathy Hochul recently weighed in with her opinion on the matter. "Why does the state legislature and the governor have to weigh in on whether or not a school district in the city of New York has speed cameras in school zones?" Governor Hochul said in a recent interview hosted by City & State NY.<sup>52</sup> "Tell me why that has to be relegated to an issue that becomes a political football at the end of a session in terms of extracting promises, concessions. I don't want to govern that way."

## 3 Explore ways to ensure that low-income violators are not unduly burdened by fines

The City already has a "moderate-income and hardship" payment plan, under which New Yorkers who earn less than \$86,400 per year are eligible to pay reduced fees for parking or camera-based tickets.<sup>53</sup> It is unclear (and thus far untested) whether these qualify under the State's new payment plans capped at 2% of income. Regardless, the City should bring its plan into line with the State's, which is a task for the Department of Finance.

In addition, the City should explore a forgiveness program for low-income violators who change their behavior. The vast majority of those who receive

speed-camera tickets do not receive another one. The City should explore an approach whereby low-income drivers can have their initial ticket fine reduced if they do not violate within a certain period. This approach would be based on a similar approach used in Scandinavian countries, which have been global leaders on traffic safety, and use a violator's income as the basis for the fines assessed.<sup>54</sup> In addition, the deadline for payment of tickets should be expanded from 30 days to 60 days, so that lower-income drivers have more time to pay fines. The first step on this would likely be a feasibility assessment, which could be led by the Mayor's Office of Criminal Justice, given its connection to the overall question of how fines disproportionately penalize low-income New Yorkers.

#### 4 **Ensure that camera-enforcement systems operate fairly and transparently**

Much of the public resistance to camera enforcement stems from the perception that the cameras are part of a “money grab,” designed to create revenue rather than to ensure safety. Some are also concerned that the location of enforcement cameras extends the legacy of over-policing lower-income or nonwhite neighborhoods. The system must therefore be designed in such a way that it is perceived as fair, even by the drivers who receive only one or two tickets and are not chronic offenders. It is imperative that the City use empirical data when prioritizing camera placement, and that the public have access to and an understanding of the rationale behind where cameras go and how they operate. In the existing network of cameras in school zones, DOT data specialists have guided camera placement by identifying locations where speeding is common and there is a high incidence of pedestrian injuries.<sup>55</sup> As the network expands, a similar standard could be applied to the City as a whole.

In addition, compliance by people riding bicycles could be enhanced with the implementation of “green wave” bicycle-appropriate timing for lights on heavily used bike routes.

There should also be a limit on the length of time that can elapse between the occurrence of a violation and the issuing of a ticket, to ensure that the connection is clear and that drivers do not get tickets that seem to come out of the blue.

#### 5 **Implement a curbside management system allowing parking reservations**

The implementation of curbside management and automated parking enforcement would require several steps. While a full-scale implementation likely requires a complete switch to pay-by-plate and enforcement based on license-plate recognition, a pilot could and should get started in advance of that.

The first step would be to issue an RFP for a pilot program similar to those undertaken in Washington, Santa Monica, and Aspen. Such an RFP would designate a specific area or areas with significant delivery activity and seek proposals for companies to install and manage the system there; ideally, the pilot locations would include one in either Midtown or Lower Manhattan, one in a busy commercial area outside of Manhattan, such as Fordham Road in the Bronx or downtown Jamaica, Queens, and one residential neighborhood. Given the active solicitations by companies such as CurbFlow and Coord, it is likely that such an RFP would attract multiple proposers, which could stand up a pilot in a matter of months. After that, such a system could be scaled quickly, and encompass residential neighborhoods as well if done in conjunction with an automated, constant, ALPR-based enforcement system. Such a system would also be able to incorporate a residential permit parking system if New York ever decides to adopt one, and existing payment systems such as ParkNYC should be easily incorporated into such a system.

Such an RFP would start with a trial period, and ideally include two or more companies so that the City could evaluate different approaches side-by-side. It's important that the City reserves the ability to contract with multiple vendors in order to avoid undue control by a single player in the market. If the RFP takes a

year from starting work to inaugurating a pilot, it should be possible then to move a successful system to scale by 2025.

As the system is developed, collecting comprehensive information about the use and misuse of City streets, curbsides, and sidewalks, robust data-sharing agreements between the DOT and vendors should be implemented. If tax dollars are paying for this data, it should be made available to allow maximum public participation in making effective, fair decisions about how to manage the built environment.

## 6 Explore requiring speed limiters on TLC-licensed vehicles

It is difficult to imagine a scenario in which New York City can impose speed-limiter technology on privately owned motor vehicles. However, the City could likely require it as part of the “hack up” modifications required for vehicles that enter the taxi and for-hire vehicle fleet, a set of regulations established by the Taxi and Limousine Commission (TLC).<sup>56</sup> The benefits of such a system would be to reduce or eliminate the potential for TLC-licensed vehicles to speed, thus preventing drivers from facing the risk of fines while also achieving the public safety objectives of the City’s Vision Zero program. And, because they are constantly in motion, the 110,000 TLC vehicles make up a meaningful percentage of the overall traffic on city streets; having them following posted traffic speeds is likely to have a pacing effect on overall traffic, thus improving general road safety.<sup>57</sup>

The first step towards such a program would be initiating a pilot program to study its potential, most likely done via an RFI, which could be issued by July 2022. This would be followed by a TLC rulemaking defining such equipment as part of the hack-up required for vehicles to become taxis and for-hire vehicles. Like the City’s speed cameras, speed regulators could allow some speeding over the speed limit—such as 10% of the speed limit—before taking effect.

## Privacy and equity concerns

The biggest legitimate issue facing a further expansion of camera-based traffic and parking enforcement is the concern that it amounts to more constant surveillance that could be used for purposes far beyond DOT’s mission. The ability to track the movements of cars across the City raises significant issues, including Fourth Amendment rights, and strikes many people as a violation of contextual privacy, even among those who recognize that the act of driving on a public road is a public, not a private act. This is one reason that this report leads with a call for a new privacy act as described in Section 1.1 of this report. In addition, the City should design further safeguards into the system, including edge computing that eliminates the capture of images not needed for proof of a violation, and the destruction of data not used for a notice of liability within a short period of time.

The proposals in this chapter raise some equity issues insofar as the main recommendations here envision a fine-based enforcement system, which can disproportionately impact low-income individuals.<sup>58</sup> As recommended above, one way to address this is to give administrative judges the ability to adjust fines to account for income levels, ideally using the standard of “an hour’s pay” or something similar. New York State has already moved to end the practice of suspending licenses for failure to pay traffic fines.<sup>59</sup>

For chronic violators, New York City is legally empowered to seize vehicles that incur five red-light camera violations or 15 speeding camera violations, although it has not yet done so.<sup>60</sup> The law need not have an economic impact on anyone because it includes a non-fine approach which allows a driver whose car is subject to confiscation to take a safe driving course instead.

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## 3.2 Convert and expand bike lanes into a network that accommodates a variety of new mobility vehicles

The technology industry is creating a wide array of new types of vehicles that are truly appropriate for our City's streets: small-scale, human- or electric-powered, and operating at pedestrian-safe speeds. However, New York City has nowhere for these new vehicles to operate, nor is it playing a role in signaling to the industry what standards those new vehicles should follow. We recommend that the next administration redefine the City's bike lane network into a better-designed New Mobility Lane network that can accommodate both bicycles and these new vehicles. At the same time, the City should establish standards for what can operate in those lanes, which will shape the evolution of new vehicles.

### The problem we face

One of the most fundamental transformations in New York City over the last 20 years has been the change in the vehicles on the streets. In 2001, there were four types of vehicles on the City's streets: cars, trucks, buses, and bicycles. Many of the bicycles carried bike couriers, who darted in and out of traffic in Manhattan below 96th Street. Most trucks were making deliveries to offices and businesses, again largely in Manhattan's central business districts.

Today, even a quick glance at our streets reveals a wider variety of roles for these familiar vehicles. Bikes are now a citywide phenomenon, used more for commuting, delivering food, and general personal transportation than for delivering documents. Delivery trucks are now as common in the City's residential

neighborhoods as they are in our central business districts. Thanks to the expansion over the last 20 years of dedicated lanes, both bikes and buses are more likely to be moving at their own speeds in their own spaces, rather than darting through—or stuck in—general traffic.

Even more remarkable is the array of new vehicles on our streets. The bikes themselves have changed dramatically—in many parts of the City, they are more likely to be bright blue shared Citi Bikes than privately owned bikes. Whether shared or not, many of the bikes are e-bikes—with batteries and small motors that provide assistance to the pedals, making faster speeds and hilly rides less strenuous. With authorization from the New York City Department of Transportation (NYC DOT), Brooklyn-based startup Revel has deployed 3,000 electric mopeds around the City, which have attracted 400,000 registered users (or 1 out of every 20 New Yorkers).<sup>1</sup> NYC DOT is currently conducting an e-scooter pilot in the Bronx, which, if successful, is likely to lead to a citywide deployment that could rival Citi Bikes in sheer numbers.<sup>2</sup> Amazon is using cargo bikes with trailers for deliveries.<sup>3</sup> Further, New Yorkers have purchased new types of vehicles on their own—ranging from standard e-scooters to motorized skateboards to gyroscope-enabled new mobility vehicles like the OneWheel.<sup>4</sup> Many observers describe these as micromobility—vehicles that are smaller than the human they are designed for.

But micromobility vehicles are only the tip of the iceberg. Amazon, FedEx, and UPS have all announced a conversion to electric delivery vehicles, some of which



are much smaller than traditional delivery vans.<sup>5</sup> In addition to Amazon's bikes-pulling-wagons, UPS has piloted an integrated cargo bike design in Seattle.<sup>6</sup> In Houston, Texas, and Scottsdale, Arizona, a startup called Nuro has been operating autonomous delivery trucks that are half the size of standard cargo vans and designed to operate no faster than 25 miles per hour.<sup>7</sup> Zoox, an autonomous vehicle company recently acquired by Amazon, launched a bidirectional, small-scale vehicle designed expressly for urban applications in 2020.<sup>8</sup>

All of these new vehicles—the ones already on our streets and the ones soon to come—share two common traits. First, they are smaller than standard cars and trucks, and especially narrower. Second, they share the propensity to travel at about the same speed. A casual cyclist will bike at around 10 miles per hour; an aggressive delivery person might be doing 15 mph; only an athletic speedster is likely to bike at 20 mph. While e-bikes can go up to 25 mph and Revel mopeds can go up to 30 mph, they—along with basically any vehicle with an electric motor—can easily be speed-limited. And any vehicle with self-driving capability can easily be programmed to follow the established speed limit. Finally, they are non-polluting: human powered, electric-powered, or both, they could be zero carbon (when the grid is finally all renewable) and they don't spew gases into our air.

We can call these “new mobility vehicles”: designed not for the highway, but for streets populated by pedestrians and cyclists.

Just as New York is one of the most important markets worldwide for companies like Uber and Airbnb, New York City represents the biggest and most important potential market in the United States for the companies that make these vehicles. Nowhere else in the nation are there so many relatively short commutes where a slow-speed vehicle would be better than the other options of buses, subways, and driving. It's the kind of marquee market that such companies would like to break into early in their growth.

New mobility vehicles and New York City should be a match made in heaven. But New York has consistently lagged smaller cities in the United States and around the world in embracing these new urban technologies.

## Definitions

**AV (autonomous vehicle):** A self-driving vehicle.

**E-bike:** A bicycle with a battery-powered electric motor; some (Class 1 by New York City Department of Transportation standards) are “pedal-assist,” and require the rider to always pedal as well. Class 2 e-bikes have pedals but can be operated with a throttle alone and no pedaling, with maximum speeds of 20 mph; Class 3 e-bikes are also throttle-operated, with pedals, and a maximum speed of 25 mph. None of these requires a driver's license to operate.

**E-scooter:** A two-wheeled scooter with handlebars and a floorboard or seat, powered by an electric motor.

**Geofencing:** A technology that establishes a geographic boundary in which a device's use is subject to certain rules implemented through computer code; this relies on the device accurately identifying where it is, through GPS, beacon, or other technology.

**GPS (Global Positioning System):** A satellite-based navigation technology that allows a device to determine its location.

**Moped:** A vehicle currently defined by New York State as a “limited-use” motorcycle, in practice meaning that it cannot achieve highway speeds. While mopeds that can operate faster than 30 miles per hour require the rider to have a motorcycle license, class B and C mopeds that cannot go faster than 30 miles per hour do not require a special license. Class A mopeds, which can reach 40 mph, require a motorcycle license.

**Micromobility:** Vehicles (or movement using such vehicles) that are smaller than the people riding them, such as bicycles, skateboards, and scooters, whether powered or not.

**NMV (New mobility vehicle):** Any vehicle that is small, lightweight, and has a speed and acceleration profile that makes it a non-disruptive presence operating in a space designed primarily for bicycles. Examples could include e-scooters with speed limiters; small-scale, speed-limited autonomous vehicles; and golf carts with speed limiters. This chapter calls for the New York City Department of Transportation to make a final determination as to what would qualify for this designation.

Bikesharing arrived in New York five years after it arrived in Montréal. Shared e-scooters hit the streets of Santa Monica, California, in 2017; they won't be citywide in New York until at least five years after that. Major-carrier cargo bikes have been in use in German cities since 2012.<sup>9</sup> In New York, such vehicles remain a curiosity.

Two related challenges make it difficult for new mobility vehicles to arrive in New York quickly, and reduce the City's ability to shape the vehicles of the future.

The first is that we lack a place for these vehicles to operate. They aren't really at home in traditional vehicle lanes: a Revel moped or a little Nuro delivery van would be uncomfortable in the shadow of a garbage truck or bus, and much slower than many of the cars on the City's streets. Highway-ready vehicles are designed to carry heavy loads and provide crashworthiness at high speeds, but new mobility vehicles are designed to be slow. Their safety derives from a relative lack of kinetic energy. And New York City's streets are too congested to allow room for error.

These new mobility vehicles have more in common with bikes than with cars and trucks designed for the highway, or pedestrians on the sidewalk. It's the same reason that adult bikes are not legal on sidewalks. A bike's 10-15 mph speed is much faster than a pedestrian's 3-4 mph; as a result, a bike on a sidewalk both interrupts the flow of people walking, and puts them in danger, because the kinetic energy of a cyclist on a bike means they could seriously hurt, or even kill, a pedestrian in a collision.

In terms of speed (as long as limiters are installed) and characteristics, these new vehicles are generally most compatible with bicycles. However, there is currently no room for them in the City's bike lane network. NYC DOT's current standard for bike lanes is between four and six feet.<sup>10</sup> While this is (usually) enough space for one cyclist to pass another, it means that a cargo bike effectively blocks the lane. Similarly, other vehicles, such as the Nuro and Zoox AVs, are simply too big to fit. Further, in many cases, state and local rules bar such vehicles from using the bike lane. As a result, drivers, cyclists, and pedestrians can all find reasons to complain about new technologies, legitimately.

“The relationship between new mobility vehicles and New York City should be blissful. But it is not.”

The second challenge is that New York's laws governing mobility are reactive. Quite narrow changes in the rules governing the streets that elsewhere would be delegated to regulators require legislation in New York. This dependence on elected legislators politicizes decisions that could and should be evidence-based, essentially ensuring an innovation process that is disruptive—simply because no path exists to innovate through an established channel.

New York's tortured path to making e-bikes legal is a case in point. Initially, New York State's ban on e-bikes did not distinguish between pedal-assist bikes and fully motorized throttle-controlled bikes. Ironically, this ensured that the only way pedal-assist bikes could enter usage was illegally, which led directly to the kinds of unsafe designs and practices that opponents complained about—which, in turn, led to even harsher policies and legislation penalizing those who used e-bikes illegally. In contrast, other cities, states, and countries had regulatory approaches that allowed for negotiated innovation to take place, and the public's interest in safety and tracking to be honored.<sup>11</sup>

Similarly, the extent to which these rules are made by legislation leads to legislative errors, oversights, and political influences that delay the introduction of new technology. Then-Governor Andrew Cuomo vetoed a bill that would have legalized e-bikes in 2019, only to reintroduce virtually the same legislation months later, leading to a yearlong delay.<sup>12</sup> When New York State finally legalized e-bikes, it established a unique 36-inch width maximum on cargo bikes, despite the fact that cargo bikes in widespread usage are between 48 and 55 inches wide. This is currently hindering the adoption of cargo bikes in the state, and awaits new legislation in Albany to correct the error.<sup>13</sup> The same law banned the use of e-bikes on the Hudson River Greenway, allegedly because of crowding, although no study establishing a risk was undertaken.<sup>14</sup> The City



Commercial cargo bikes are already being piloted on NYC streets.

Photo credit: NYC Department of Transportation.

A wide variety of urban-friendly new vehicles are emerging that are compatible with bicycles and yet currently have nowhere on New York City's streets to operate



Amazon uses bike trailers for Amazon Prime deliveries in Manhattan and Brooklyn.

Photo credit: Ben Oldenburg.



Zoox represents the potential for small, electric, autonomous ride-hailing vehicles.

Photo credit: Zoox.



Revel electric scooters have become a common sight on New York streets.

Photo credit: Revel.



Domino's is experimenting with delivering pizza via autonomous Nuro delivery vehicles in Houston.

Photo credit: Dominos.



Lime, Bird and Veo e-scooters were recently selected for a scooter-share pilot in the Bronx.

Photo credit: NYC Department of Transportation.

Council was aggressively against e-bikes until recently, and continues to pass legislation that seems to exclude a variety of vehicles; in 2019, it mandated a planning process for NYC DOT that include an enhanced bike lane network “for the exclusive use of bicycles,” which fails to consider whether other vehicles could use the bike lane.<sup>15</sup>

Ironically, evidence exists that the inability to accommodate a wider variety of vehicles is an ongoing impediment to the full expansion of bike lanes in New York City. Bike lanes have obtained increased political support across New York over the last decade, and many advocacy organizations and mayoral candidates have indicated support for a significant expansion.<sup>16</sup> However, a constant political obstacle is that bike lane proposals are perceived as a zero-sum game with motor vehicles: any space given to bikes comes at the expense of less room and greater congestion for drivers. It is also the case that many New Yorkers simply don't think they will ever use a bike regularly. A 2017 survey indicated that 24% of New Yorkers said they had ridden a bike at least once in the previous year.<sup>17</sup> This is a significant sector of the population, but it is only half the number of New Yorkers who live in an auto-owning household.<sup>18</sup>

In short, New York City's relationship with new mobility vehicles is tortured. What should be a blissful love affair is fraught with tension, mistrust, and friction.

## The technology opportunity

The opportunity exists for New York City to turn itself from a follower into a leader in the field of new urban mobility—and, in the process, to help shape the vehicles of the future so they are designed to serve New Yorkers' needs. Doing this would require providing clear, performance-based rules stating what New York City wants to see in new vehicles, and also carving out a place for them to operate safely.

Creating that protected space for operation needs to be the first step. A comprehensive network of New Mobility Lanes would build on the existing bike lane network and its planned expansion. The City should widen its current and projected bike lanes in order

to accommodate a wider variety of bike-compatible, slow-speed, lightweight vehicles. This would give both existing and future new mobility vehicles a place to operate, while simultaneously offering more space to accommodate the increase in cycling.

This vision of changing the mix of users on our streets—deemphasizing cars in favor of safer, quieter, more environmentally friendly vehicles—is in line with the readjustment called for in Transportation Alternatives' “NYC 25x25” report. In that proposal, the City's leading nonprofit on issues of alternative transport calls for converting 25% of the area in the City currently dedicated to cars to people instead.<sup>19</sup>

Redefining bike lanes into New Mobility Lanes, and enforcing standards of behavior for operators in those lanes, may also broaden the appeal of the bike lane network and reduce some of the political friction that has traditionally surrounded it. Drivers understand that trucks are a significant aspect of congestion, so the prospect of moving cargo into a separate lane may appeal to them. Although e-scooters are too new to offer really good data, there is evidence from other cities that they replace car and taxi trips more than they replace cycling trips, suggesting they may draw in more users.<sup>20</sup> The prospect of enclosed, powered, slow-speed vehicles such as a Zoox transit/taxi vehicle in those lanes should expand their appeal to include many who would never consider themselves cyclists.

New York City, by establishing New Mobility Lanes, could also gain the ability to regulate which vehicles could use these desirable new facilities. Much as DOT has set stringent requirements for the e-scooters in the Bronx pilot—requirements that the scooter companies have been willing to meet, given the City's market size—it could establish standards for a much broader set of new mobility vehicles. The City could require certain heights, weights, and widths; safety features to protect cyclists and pedestrians from collisions; and data feeds to be able to fine operators for illegal maneuvers. It could mandate speed regulators to ensure that these vehicles never go too fast, and geofencing to prevent them from driving on the sidewalk. It could determine how much noise such vehicles could make, and require them to be zero-emission.

The attraction of such a route network in the largest city in America would likely be enough to lead many companies to design their vehicles to New York's standards. For users, the ability to operate in a dedicated lane would mean lower overall travel times, given that Manhattan central business district traffic moves at an average speed of seven miles per hour.<sup>21</sup> Both manufacturers and fleet users should be attracted to the visibility of New York City's streets as a marketing arena. By offering standards, the City could help ensure that the next generation of mobility innovations interact well with the original pro-urban vehicle: bicycles.

## An agenda for the next administration

New York has the opportunity to redesign its streets for an entirely new generation of low-speed vehicles, which will revolutionize the way we travel around the City and deliver goods and services. By building out this network with an eye to encouraging alternatives to traditional gas-powered vehicles, we can make our streets safer and our air cleaner, while simultaneously improving transportation options for New Yorkers of all ages and abilities.

### 1 Redesign NYC bike lanes to be wider New Mobility Lanes, and build out the network

The first step in implementing a New Mobility Lane network will be the design of new standards for the network. Those should then be applied in the construction of all new bike lanes, and, as roads get resurfaced, to existing bike lanes as well. Routes that are heavily used by bicycles and micromobility vehicles, as demonstrated in DOT data collection, should be strategically prioritized. To replace the 4- to 6-foot widths that are currently standard, DOT should adopt a 10- or 11-foot standard, which would allow cyclists to pass each other comfortably and go around cargo bikes or AV shuttles stopping for delivery or pickup. (This type of lane would only be feasible on wider

streets and avenues with multiple traffic lanes; implementation on narrow streets would be contingent on removing parking.)

A key task feature of the new design would be physical barriers that make it impossible for traditional vehicles to invade the New Mobility Lane, whether unintentionally or not. Because the new lane will be as wide as many vehicle lanes, such barriers will be necessary both on the sides of the lanes and at the entrance on each block. A simple post that prevents vehicles wider than a certain width from entering should be sufficient.

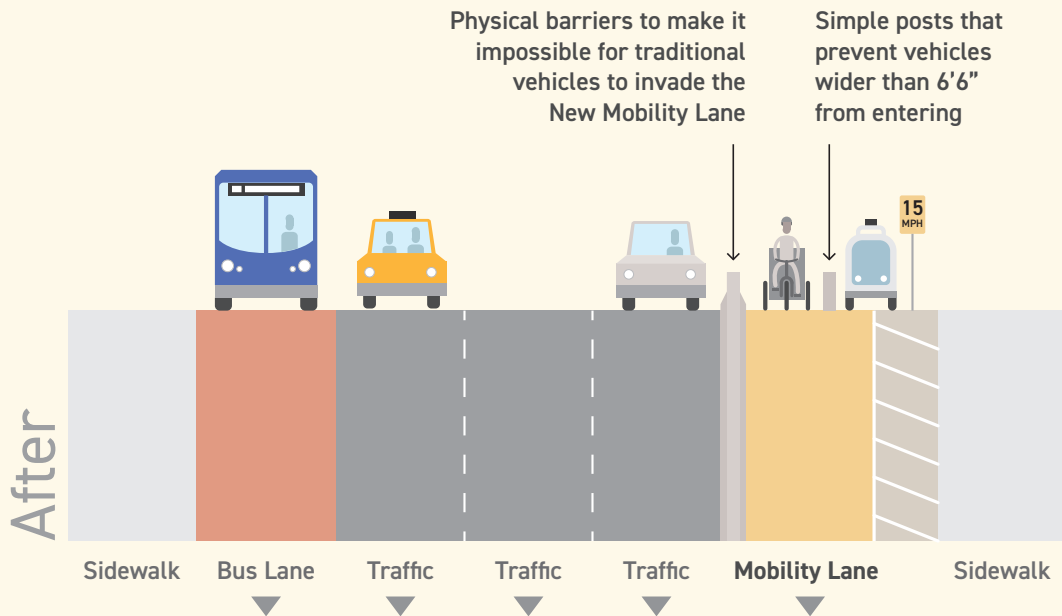
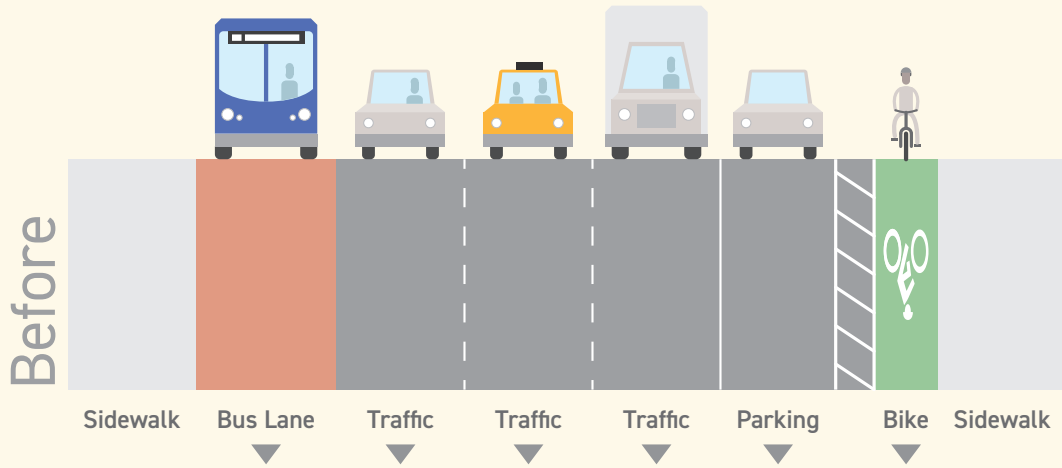
NYC DOT will also need to establish a speed limit for the New Mobility Lanes, which should be no faster than bike speeds. A limit of 15 miles per hour has widely been discussed as appropriate for motorized vehicles operating in bike lanes, including e-bikes.<sup>22</sup>

NYC DOT should be able to release initial cross-sections for a New Mobility Lane network for public discussion in the third quarter of 2022. The work is certainly within the competence of DOT's own planning team, but could also be initiated by existing contractors with whom DOT has standing arrangements. The actual construction of the lanes and conversion of existing bike routes will take several years, and DOT should assess where the lanes should be rolled out first to gain the maximum benefit at the earliest date. A significant amount could be accomplished by 2025.

In 2019, the City Council enacted Local Law 195, which requires DOT to undertake two master plans that will lay out how the agency will meet certain targets intended to improve New York's streets for pedestrians, cyclists, and other users. The first of these was just published in December 2021<sup>23</sup>; the next is due in December 2026. The New Mobility Lanes would therefore have to be added as an amendment to this first plan.<sup>24</sup>

Further, because the law sets targets for the creation of protected bike lanes, and defines such lanes as "for the exclusive use of bicycles," a legislative amendment would be needed, either to deem certain types of vehicles as bicycles for the purposes of the master plan, or to allow DOT to determine additional vehicles

New Mobility Lanes would be wider than today's bike lanes, allowing space for cyclists and others to pass any new mobility vehicles that might be stopping for drop-offs or pickups



Physical barriers to make it impossible for traditional vehicles to invade the New Mobility Lane

Simple posts that prevent vehicles wider than 6'6" from entering

Adopting a 10' standard would allow cyclists to pass each other comfortably and go around a cargo bike or AV shuttle that was stopping for a delivery or drop-off

that may have access. This amendment could be the mechanism by which the City Council can implement the new mobility vehicle standards.

## 2 Obtain State legislation allowing New York City to determine what vehicles are allowed in the New Mobility Lanes

The New York State Vehicle and Traffic Law governs the types of vehicles that may be used on the streets and sidewalks of New York State.<sup>25</sup> While the law includes several provisions allowing municipalities, including New York City, to regulate certain types of vehicles, it is likely an important step to ensure that the law grants New York City the full authority to determine what vehicles can and cannot operate within the New Mobility Lanes.

## 3 Establish vehicle standards for use of the New Mobility Lanes

In parallel—likely not waiting for authority to be granted—NYC DOT should move forward on establishing standards for what kinds of motorized vehicles should be allowed to use the New Mobility Lanes. This will likely require the creation of an expert task force, with supporting staff provided by NYC DOT and, if needed, external consultants. The Task Force should include experts on street design, advocates for cyclists, and experts on new mobility vehicles, but should exclude anyone with a significant financial interest in any type of new mobility vehicle; as a result, it should exclude representatives of companies that produce or operate new mobility vehicles, and those who invest in them. Such individuals and companies should be invited to present to the Task Force, but should not be empowered to participate in its deliberations.

The Task Force should issue a draft set of standards to the public, which would ultimately need approval from the DOT Commissioner. It could then be established into law by the City Council.

The standards the Task Force must include would be: vehicle size, speed, weight, acceleration and braking capabilities, and, in the case of autonomous vehicles, the ability to detect pedestrians and other obstacles and the auditing of logic to ensure that the vehicle errs towards caution rather than speed. In addition, inspection, registration, and marking standards must be established, as many of these vehicles will be ineligible for license plates issued by NYS Department of Motor Vehicles and will therefore need a special-purpose tag designed specifically for the NYC New Mobility Lanes.

Ideally, the Task Force would be a joint effort with one or more other cities, or with an organization such as the National Association of City Transportation Officials (NACTO), but NYC should not slow this down too long in the pursuit of partnerships with other cities.

NYC DOT should be able to appoint such a task force by July 1, 2022, if this is a priority for the incoming administration.

## 4 Institute comprehensive enforcement for New Mobility Lanes

The New Mobility Lane network will require a comprehensive, camera-based enforcement system that is essentially the same as that needed for vehicle lanes. This is to combat two risks: first, that the wider lanes will be violated by highway-capable vehicles, and second, that the motorized, small-scale vehicles the lanes are designed for will exceed its speed limits.

The implementation of this step would largely be encompassed within the broader camera-based enforcement approach described in Section 3.1 of this report.

## Privacy and equity concerns

The New Mobility Lanes raise no privacy concerns that we have identified to date, beyond the same concerns raised by the prospect of widespread camera enforcement of vehicle violations, which are addressed elsewhere in this report.

The use of new mobility vehicles such as scooters, mopeds, and e-bikes cuts across all ranges of income levels and communities. New lanes and enhanced micromobility use would reduce the need for, and burdensome cost of, vehicle ownership, reduce commute times, and improve air quality throughout the city, an issue that disproportionately affects low-income communities. The safety afforded to users of e-mobility would be of immediate benefit to the thousands of delivery workers across the city whose profession has become increasingly dangerous due to shared travel lanes with vehicles. Encouraging a shift in delivery vehicles from large vans to small-scale cargo bikes could well result in the creation of new jobs throughout the city.

The main task for incoming elected officials to ensure the equity of this proposal is to ensure that the New Mobility Lanes themselves extend into low- and moderate-income neighborhoods.

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## 3.3 Require mobility companies to offer transparent, real-time pricing and payment options

The advent of mobility apps that allow New Yorkers to book for-hire car rides, as well as to use bike- and scooter-share systems, has greatly increased the number of transportation options available to City residents. These changes have been especially beneficial to people in areas poorly served by transit, and those with disabilities, even as they have disadvantaged yellow taxicabs. But the operators of ride-hail and sharing systems have not made it possible to compare the prices and available of their services, let alone book through a single application. Greater transparency in digital mobility apps would allow riders to make informed decisions about which service they want to use, and help taxis be more competitive in New York's new transportation market.

### The problem we face

New Yorkers rely on car services more than people do anywhere else in the United States. In February 2020, the last month before the pandemic, New Yorkers took more than a million rides in taxis and for-hire vehicles each day.<sup>1</sup> In a city where the majority of residents do not own a car, for-hire vehicles fill in transit gaps and enable shopping trips. For New Yorkers with mobility challenges, these services—along with the Access-A-Ride service offered by the Metropolitan Transportation Authority (MTA)—are even more important.

Prior to the arrival of Uber and Lyft in New York City in 2011, for-hire services were largely dominated by three classes of vehicles: yellow taxis, livery cabs, and black cars. For yellow taxis, price transparency had long been enforced by regulation; before getting in,

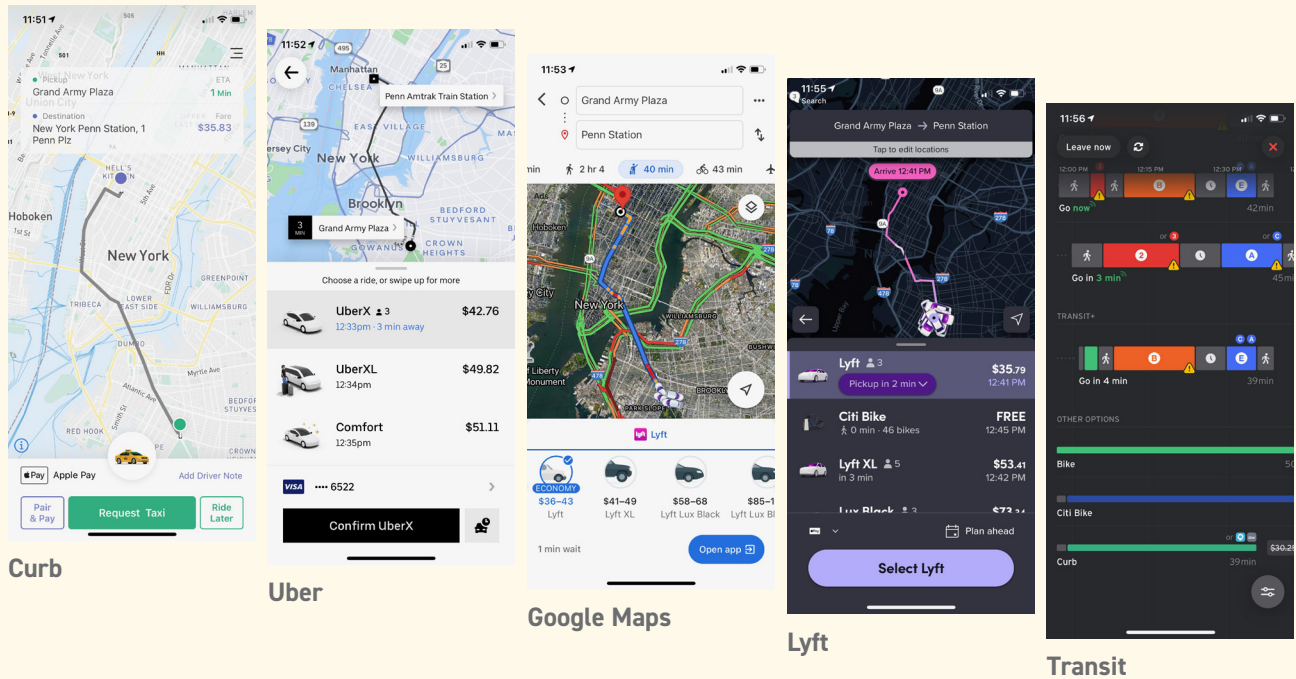
riders could see the rates stenciled on the passenger door, and then they could watch the cost of the ride ticking up on the dashboard taximeter. According to the rules, the livery cabs that served most rides outside of Manhattan below 96th Street were supposed to offer prices in advance as well. In practice, though, many outer borough residents suffered price discrimination: a driver who knew you needed a ride, and who knew you would face a long wait if you refused, would charge a high price. The Bloomberg Administration implemented the green cabs program as a way to bring the safety and price transparency of yellow taxis to the rest of the city.

Price transparency was one of the reasons that Uber and Lyft, which offered prices in advance, were a massive improvement for New Yorkers who had previously relied on radio cars. Their reliability, availability, and transparency quickly led to explosive growth, with ride-hail apps providing 74% of all daily for-hire vehicle rides prior to the pandemic. Above all, their pricing was often below the price of yellow taxis—because ride-hail companies were effectively subsidizing rides in order to attract riders.<sup>2</sup>

When the ride-hail apps did raise fares, it used to be through some variant of “surge pricing,” where a flat per-mile and per-minute rate was increased by a specified multiplier, with the driver's pay increased at the same rate. Mostly, surge pricing took place at times when all New Yorkers knew it was difficult to get a ride, so while it felt unfair to people accustomed to fixed fares, it was at least logical.<sup>3</sup>

## Pricing transparency

Despite the many apps that offer trip planning in New York City, no single app allows riders to compare prices across providers. The Taxi & Limousine Commission could require standardized, transparent data to be provided by all companies operating in the City, as well as yellow taxis, so that New Yorkers could see a price comparison in one app.



That simple “surge” mechanism has more recently been replaced by an “upfront pricing” system that displays a unique price for your trip, specific to your request, with little explanation. The price the driver gets for your ride is also disconnected from the fare you pay. Because of this, price offerings on services like Uber and Lyft are increasingly inscrutable to consumers and regulators. Few understand the mechanics of how they are delivered. The prices are highly tailored: just as Facebook tailors ads and content to you based on what you have looked at and responded to before,<sup>4</sup> mobility companies serve you offers customized to your specific time and location. The potential exists for mobility companies to more carefully tailor the offers, using knowledge about your individual travel habits.<sup>5</sup>

This opaque pricing might not be detrimental if prices were generally low. But, in part as a result of their becoming publicly traded companies, ride-hail apps have been raising their prices in order to reach profitability, a trend accelerated by drive shortages during the pandemic recovery.<sup>6</sup> A recent analysis by

the research firm Rakuten Intelligence found that the cost of a ride was up 40 percent year over year in April of 2021.<sup>7</sup>

In theory, this should be good news for taxi drivers, who have suffered from the emergence of the ride-hail apps. If New Yorkers were able to use technology to compare prices across Uber, Lyft, taxis, and even transit and Citi Bikes, there wouldn’t be a problem. Riders would choose the ride that made the most sense to them, factoring in convenience, time, and cost.

Unfortunately, that isn’t possible. Both Uber and Lyft have shut down previously public Application Programming Interfaces (APIs) that allowed third-party app developers to create price comparison tools. Even when APIs were available, the companies frequently prevented app developers from building price comparison tools.<sup>8</sup>

As a result, the extent to which we have come to rely on technology has, inadvertently, returned us to the old days: a New Yorker who needs a ride is being charged based on their level of need rather than on reasonable pricing that is transparent to all.

This concerning lack of transparency doesn't just originate with mobility operators—larger software platforms that aggregate these services may also impair consumer choices. Services such as Google Maps, while not operating mobility services themselves, have enormous power by virtue of their immense base of users. Their choice of what services to include in their offerings can have significant consequences for the success or failure of new modes of transportation. In Denmark, Google was recently pursued for offering its users access only to Lime (in which Google's parent entity has an ownership stake) and not local competitors.<sup>9</sup> The practical impact of decisions like this, whatever their motivation, is that you might not know about a service that could serve your needs because your chosen navigation app might not show it to you.

All mobility apps now aspire to the power that Google Maps has to shape mobility choices, since the potential for extracting revenue from these arrangements is potentially significant. Google advertises for services directly within Google Maps. As an example, as of the writing of this document, only Lyft is available in the ride-hail and taxi segment of Google Maps in New York City. While no public statements have been issued about this choice, it suggests that Uber, Curb, and other taxi and ride-hail providers have not reached a suitable commercial agreement with Google. While keeping them out of Maps may benefit Google, it's far from obvious that it benefits consumers.

But the potentially negative impacts extend beyond the individual user. Services that limit the potential for competition and interoperability of mobility services also lessen the overall appeal of shared mobility services. That, in turn, will limit the potential of these new services to entice more New Yorkers out of their own personal vehicles. It also could lead to greater duplication of services, reducing efficiency.

Finally, because the pricing offered to users is opaque, the potential for charging higher rates to lower-income neighborhoods is real, as evidenced by past studies that

measured wait time differences in different neighborhoods using public fare access points—access points that have now been closed by the mobility companies that do not want their pricing to be transparent.<sup>10</sup>

The challenges of the new digital mobility marketplace are not occurring in a vacuum. The rise of app-enabled competition, combined with the dramatic impact of the COVID-19 pandemic, has decimated the city's yellow taxi industry and left many drivers in deep financial distress. The City's Taxi & Limousine Commission (TLC) has been working to address this challenge with direct financial assistance to drivers. A focus on consumer data interfaces, as outlined in this chapter, could support these efforts by sparking a post-COVID taxi ridership renewal.

To understand how, consider that there is now ample evidence that yellow taxis are now frequently cheaper than their app-enabled counterparts. This price competition should enable a rebound in trip volumes, but lower prices would be more influential on consumer choice if they were more easily discoverable by consumers. Many users are limited by the relative inconvenience in comparing prices at the moment of booking a ride. Open-data feeds that allow consumers to find and book services could address this problem and provide further support to the TLC's efforts to build a more resilient and thriving yellow taxi industry in the years to come.

Last but not least, the TLC's accessible dispatch service exists to provide the most convenient ride to users with mobility impairments.<sup>11</sup> The city has required more and more taxicabs and for-hire vehicles to be wheelchair-accessible, and worked to develop increasingly sophisticated mobile apps for users. Having a publicly accessible data feed of all available services—whether taxi or other for-hire vehicle—would allow the TLC to quickly incorporate wheelchair-accessible vehicles from fleets of all kinds. This should enable the City to create an increasingly accessible and convenient service for more people in more parts of town.

## The technology opportunity

Technology tools exist that have started to address the problems above. The solution lies in a push for a greater degree of transparency in digital mobility. Sunlight, as the saying goes, is the best disinfectant, and sunlight in digital mobility markets comes in the form of open data.

Public transportation agencies laid the groundwork by developing what is now known as the General Transit Feed Specification (GTFS).<sup>12</sup> This data standard is what transit agencies across North America use to publish open and accessible information on their real-time service offerings, including the real time location of buses and trains in service.

That success has extended to other modes of transportation over time. The bikeshare industry developed the General Bikeshare Feed Specification (GBFS) in 2015,<sup>13</sup> and it has since been expanded to dockless bike share and scooter services. It has wide but far from universal adoption, but provides a tool for the city of New York to use to continue to push its bike and scooter operators to provide a more transparent service offering. In fact, it was the availability of these open data feeds from the City of New York that allowed so-called “civic hackers” to identify supply problems within the Citibike system before the city did.<sup>14</sup>

When it comes to taxi and ride-hail services, no data standard yet exists that mimics what GTFS and GBFS already do. But there are plenty of ways for New York City to push the ball forward on this issue immediately. Ensuring that both transportation consumers and operators benefit from a fair and well regulated market for rides has been the core concern of the TLC since its inception. Adopting new consumer-facing data tools will set the course for 21st-century mobility regulation.

As described in the city action plan below, the TLC should get involved in an effort underway to define a data standard that would serve the needs of taxi and for-hire services.<sup>15</sup> Once such a standard is developed, the TLC can move to ensure that all taxi and for-hire companies make a feed public available under a permissive license. Even in the absence of a

“Adopting new consumer-facing data tools will set the course for 21st-century mobility regulation.”

standard, the city can move to make data-sharing with consumers mandatory using the same authority it has used to collect data from the operators themselves.

This would be a natural and logical extension of the TLC’s existing work. New York’s TLC has one of the world’s most extensive programs of data collection in the world for services like Uber and Lyft. It collects detailed records of trips and driver working hours, and uses these to enforce everything from hourly pay minimums to ride surcharges. Requiring standardized consumer-facing data feeds would be a natural extension of the TLC’s existing data requirements.

The final critical piece of the mobility ecosystem is fare payment. While the data described above would give consumers a real-time and accurate sense of how the system is operating and what prices are being charged, allowing them to actually pay for rides in the same place would move things one step further. Here, data standards are far from universal, but the city could take steps to push its technology vendors to offer public APIs or Software Development Kits (SDKs) that third-party app developers could easily integrate, making seamless payment available to more people in more places.

## An agenda for the next administration

New York City, the largest market for urban mobility in the country, has an opportunity not just to set the course for its own future, but also to alter the pathway of urban mobility tech adoption for the country. The power to create an open, interoperable, equitable, and competitive future of mobility does not lie with any one agency. Each of the New York City transportation regulatory agencies has a role to play.

## 1 Require open data feeds and payment APIs for taxi and ride-hail operators

The TLC has the power to require that taxi and ride-hail services make available public-facing data feeds for consumers using their existing data-collection authority. In doing so, they would enable users to find and book their preferred services in a transparent way that promotes competition, facilitates interoperability with public transportation, and gives a leg up to local competitors.

First, the TLC should immediately join the development of a new data standard for taxi and on demand ride services being developed by MobilityData, an international nonprofit focused on these issues.<sup>16</sup> Ensuring that this emerging data standard—GOFs—is practical for the TLC’s licensees is vital to ensuring its success.<sup>17</sup> By joining the effort, the TLC would immediately become one of the most influential voices in the process and could significantly bolster the effort, helping draw in operators, tech platforms, and funding to the problem. This step could take place immediately.

Second, the city should also begin the process of requiring consumer-facing data feeds from taxi and ride-hail operators, using its existing data-collection authority. This request could borrow language and approaches already in use by the New York City Department of Transportation (DOT), which requires public-facing consumer data feeds from bike share and scooter operators under the GBFS data format.

Third, the city should begin to require its operators to make it possible to actually book and pay for a ride in the app or service they choose. To do so, the city could require that app-based ride services make available mobile payment APIs or SDKs for third parties. In doing so, they would build on the experience that other cities have in requiring such interfaces for bikeshare and transit operations, described below.

## 2 Require open payment APIs for bike share and shared scooter systems

The NYC DOT has regulatory authority over docked bike share systems and shared electric scooters. For both of these modes, the existence of GBFS, a widely adopted data standard developed in 2015, has allowed DOT to require public-facing data feeds for several years. They should continue to require this data and regularly enforce this mandate. For more resources, NYC DOT can follow the North American Bikeshare & Scootershare Association (NABSA) “Data Good Practices for Municipalities” and MobilityData’s “Shared Mobility Data Policy” guidance.<sup>18</sup>

New York City DOT’s existing requirements have ensured the development of a robust ecosystem of providers and consumers of these data feeds in New York. That leadership position opens up the space for DOT to go beyond what’s already available. Specifically, DOT should address the missing piece of a fully integrated multimodal ecosystem by pushing bike and scooter operators to make standardized payment systems available for third-party bookings, which would enable not only single rides to be purchased but also the evolution of “mobility as a service” apps that bundle multiple trips. While no single data standard exists for fare payment, NYC DOT can require operators to make APIs or SDKs available to third-party apps and services. This effort could build on existing regulations in other jurisdictions. Chicago’s DOT, for example, already does this in their bikeshare contract,<sup>19</sup> requiring operators to “work cooperatively, and in good faith, to enable such third party to integrate System data and enable purchase of rides at publicly available rates.”

## 3 Require open-payment APIs for public transportation systems, starting with the NYC Ferry

The MTA controls the largest public transportation system in the country, and has the opportunity to make public transportation the backbone of a new, more transparent digital mobility system. The MTA already makes freely available data available to consumers on

the real time location of buses and trains using the GTFS-RT data standard. It has also started to embrace open loop payment systems with the rollout of the OMNY system.

Other cities have taken the final step towards openness and enabled third-party mobile apps to book and pay for rides. In Denver, the Regional Transportation District required its mobile ticketing provider to make third-party payment APIs available to third parties, so that you can now buy your transit ticket seamlessly in the Lyft, Transit, and Uber apps.<sup>20</sup>

While the MTA is controlled by the Governor, the Mayor and the City Council could encourage the MTA to undertake this step. Further, the New York City Economic Development Corporation could implement this directly on the NYC Ferry, which could help encourage third-party apps to make the ferry system more visible and attract riders.

## Privacy and equity concerns

While ride-hail services raise many potential privacy concerns, we have identified no issues related to privacy with this proposal, because it proposes to make public information that has no association with individuals (i.e., the availability of trips and their pricing). Each third-party app that uses the data might attempt to capture usable information from the trips that a user searches for or books, but these would raise the same issues as data currently captured by widely used apps such as Google Maps and Apple Maps.

This proposal raises no inherent equity issues that we have identified. The availability of data should make it possible for third-party researchers to determine whether ride-hail providers are charging different prices in different locations, which may help prevent price discrimination based on geography and thus promote equity. While ride-hail services are used more frequently by those with higher incomes, they are used across the City and are not only a service for the wealthy.

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## 3.4 Propel New York City’s design and construction industry into the digital age by moving to automated code review

Building codes in New York City serve the important purpose of ensuring that the City’s one million structures are safe, healthy, and energy efficient. They do so by creating enforceable rules governing the plans and designs that shape construction and renovation. However, the building industry has been slow to embrace technology that can make construction cheaper, faster, and more convenient. At the same time, the City agencies that oversee these codes rely too heavily on professional self-certification and embrace a permitting process that is so byzantine that property owners and contractors rely on “expeditors” to get permits faster. The opportunity exists for the next mayor to push the entire building industry to embrace a new approach to design software by making building information modeling (BIM) the standard way to submit plans for review to the City. This will require the creation of new guidelines, but will lead to more compliant plans, lower costs, and faster construction projects, giving New York City companies an edge as the rest of the world makes this long-sought transition.

### The problem we face

As in many dense cities, life in New York City is disproportionately shaped by our building and construction industry. The cost and time of construction shapes the cost and quality of housing we live in; this is true whether we are talking about the construction of a new Midtown skyscraper or the renovation of a kitchen in a single-family home in Staten Island. While the City’s construction industry is clearly one of the world’s best, it has been slow to embrace new technology. One reason that the cost of housing is so high is that overall productivity in the construction industry has actually declined over the last 20 years, while it has increased dramatically in most other sectors of the economy.<sup>4</sup>

There are several steps in the process of constructing a building or renovating an apartment, but the design and approvals portion is often one of the most time-consuming and frustrating. This step involves both design professionals and contractors who work for the developer or homeowner, as well as City agencies charged with overseeing the codes that govern how buildings are designed, constructed, maintained, and regulated. These codes ensure that buildings and construction sites are safe, that buildings are designed to be healthy and energy efficient, and that they are maintained properly. Most of these codes are managed by the City’s Department of Buildings (DOB), but others are not—most notably, the New York City Fire Code, which is overseen by the New York City Fire Department (FDNY).<sup>5</sup> Most importantly, construction cannot proceed until a plan has been submitted to the DOB and a permit has been issued indicating that the agency believes the plan conforms to code.

## Definitions

**ACC (automated code checking):** ACC is also known as automated plan review and automated compliance checking.

**BIM (building information modeling):** A process that begins with the creation of an intelligent 3D model and enables document management, coordination, and simulation during the entire lifecycle of a project (plan, design, build, operation, and maintenance).

**CAD (computer aided design):** CAD is typically used by engineers to design mechanical and electrical assemblies, whether that be an airplane or an iPhone. BIM, on the other hand, is only used for designing and constructing buildings.<sup>1</sup>

**ICC (International Code Council):** The leading global source of model codes and standards. The ICC's model codes are tweaked by jurisdictions for local conditions and requirements.

**Prescriptive vs. performance language:** Any provision of a code, standard, or rating system may be defined prescriptively or in terms of performance. A prescriptive provision states precisely what must be done, e.g., “must be attached with 10d nails at 6 inches on center.” A performance provision sets a minimum requirement for how the component performs—e.g., “must be able to sustain a lateral point load of 200 lbs.”—without prescribing how that minimum level of performance is to be accomplished. Most model codes offer both prescriptive and performance options.<sup>2</sup>

**ProCer (professional certification,<sup>3</sup> also known as self-certification):** The New York City Department of Buildings (DOB) offers a Professional Certification Program which enables professional engineers and registered architects to certify that the plans they file with DOB are in compliance with all applicable laws. This reduces the amount of time a builder normally has to wait for a permit by eliminating the process of plan examination and approval.

Over the last 20 years, both the construction industry in general and the DOB in particular have sought to embrace technology in this process of design, code review, and permitting. For the last 30 years, it has been standard for complex plans to be drafted not on two-dimensional paper, but in computer drawings called computer aided design (CAD), or even more advanced tools described as building information modeling (BIM). These highly sophisticated applications can not only produce digital drawings in three dimensions—as the building will be built—but also can perform advanced analysis on the design. These analyses include critical tasks such as testing for material strength, estimating the cost of construction, understanding livability, and allowing for the easy comparison of design alternatives.<sup>6</sup>

While most architecture and engineering firms are using this software, there are a wide variety of suppliers and systems that different firms use. As a result, while CAD and BIM systems have made the work within firms much more efficient and precise, they have not significantly addressed the high cost of coordination among the many players involved in even small renovation projects, which could include a general contractor, various subcontractors, structural engineers, an architect, and the owners.<sup>7</sup>

The promise of BIM technology is to ensure that all participants are using 3D plans that communicate effectively with each other. But that promise has gone unrealized. Interoperability is a crucial and documented impediment to automated code checking (ACC).<sup>8</sup> Nationwide, the cost of inadequate interoperability in the US capital facilities industry is estimated to be \$16 billion annually—and likely at least \$400 million annually in New York City, extrapolating conservatively, with the City counting as 2.5% of the US population.<sup>9</sup>

New York's DOB has been successful at embracing technology, but has largely done so thus far only within its own internal processes. Since 2000, the agency has progressed from a situation in which the City's building codes were literally only available on paper to a place where the codes are available online and permit applications may be submitted electronically. The \$29.6 million DOB NOW system, implemented in 2016, allows members of the public and the architecture, engineering, and construction (AEC) sector



to do their business with the department online, including submitting and tracking applications in real time, pulling permits, scheduling appointments, and checking inspection statuses.<sup>10</sup>

DOB NOW has streamlined many aspects of DOB's permit approval process, but it has not fundamentally changed that process. For example, DOB NOW does not eliminate the need for thousands of expeditors to navigate the bureaucracy.<sup>11</sup> Further, while DOB NOW has streamlined the process of submitting and reviewing plans, it has not changed the way plans are reviewed. In most cases, the documentation submitted is not machine-readable, and plan examiners continue to review documents in paper-like formats such as Adobe Acrobat files.

Plan review is one of DOB's most critical and labor-intensive tasks. DOB employs some 200 plan examiners, in theory to review nearly 100,000 applications annually.<sup>12</sup> In reality, however, only a portion of these are actually reviewed. Since 1975, DOB has allowed state-licensed design professionals (registered architects or professional engineers) to self-certify that their plans conform to code, using a program called ProCert. In return, so long as there are no changes to the use, egress, or occupancy of the building, DOB offers an expedited permit.<sup>13</sup> ProCert is particularly helpful to keeping things moving in the field of residential renovation.<sup>14</sup> In 2020, 62.2% of all job filings traveled this path.<sup>15</sup>

While efficient, the dependence on self-certification essentially transfers the risk from DOB onto design professionals. The professional is at risk of losing their license if their submitted plan is found not to be in compliance. DOB aims to audit 20% of all submitted plans, and occasionally seeks action against professionals whose self-certified plans have too many instances of non-compliance.<sup>16</sup>

In reality, however, self-certification is not a true substitute for plan review. In fiscal year 2020, DOB audited only 11.9% of self-certified plans. Of those, 44.2% were found not to be in compliance.<sup>17</sup> The severity of these instances is unclear; in all likelihood, few or none directly threatened the safety of New Yorkers. However,

“If the construction industry can move to a more seamless use of technology, it could unleash the same benefits that offices have seen in moving to cloud-based software.”

such a high failure rate suggests that ProCert is not an ideal workaround for the time-consuming labor of manually checking plans.

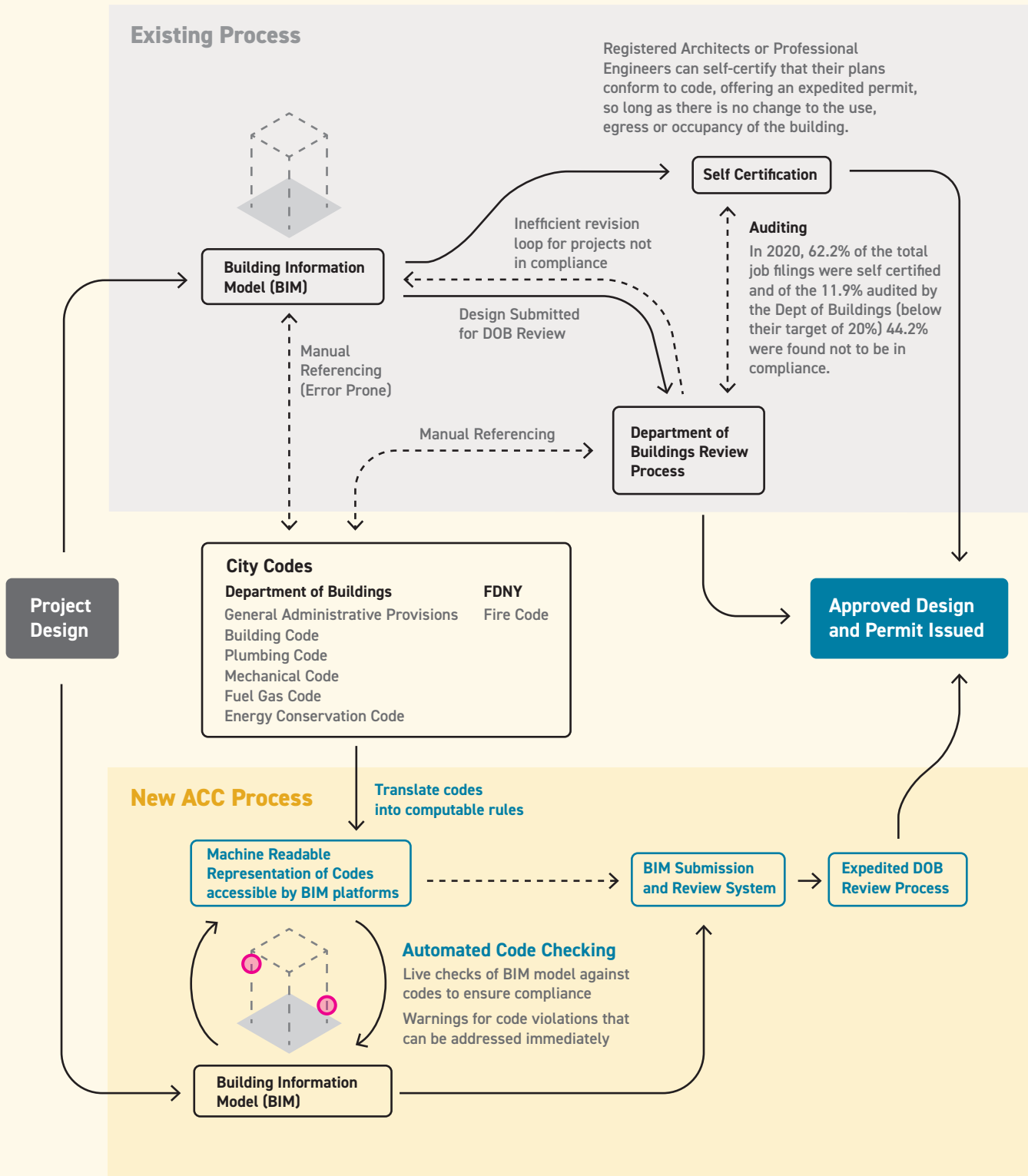
## The technology opportunity

Automated code compliance (ACC) offers a future in which DOB's role in enforcing code compliance is streamlined and enhanced, while also serving as a catalyst to increase the productivity and innovation of New York City's design and construction sector.

The widespread use of CAD and BIM systems in the building and renovation design process, although disjointed, has led many to believe that the industry is one major step away from an era of far greater standardization, smoother operations, and higher performance. In many ways, the industry's use of technology is akin to the implementation of word processors 20 or 30 years ago, when all documents were typed on a word processor, but were shared for the most part on paper, in large part because there were many software programs and they did not communicate with each other. If the construction industry can move to a more seamless use of technology, it could unleash the same benefits that offices have seen in moving from WordPerfect and MacWrite to Google Docs and Microsoft Word.<sup>18</sup>

Research suggests that only the government can force the industry to make such a transition.<sup>19</sup> While each individual player may find the necessary work-process changes to be tedious, or seemingly unnecessary for day-to-day success, these growing pains must be borne

## Automated Code Checking can streamline NYC's permitting process



“The ability of BIM systems to incorporate the codes themselves means they can provide the equivalent of spell-checking to plans—not replacing code review by an experienced plan examiner, but using computer code and machine learning to identify where there are noncompliant aspects of a plan.”

in order to move the entire industry forward and help reduce the cost of housing and other types of construction work in New York City.

Two international examples—Singapore and South Korea—demonstrate the need for the government to take the lead. Singapore developed a detailed BIM Roadmap that is worthy of emulation: their Building and Construction Authority successfully paved the way for greater BIM adoption, a prerequisite for ACC. They developed CORENET, the first electronic BIM submission system, collaborated with government procurement entities to request BIM for their projects, created standardized templates and guidelines to help professionals understand the new process of regulatory submission, promoted success stories, built BIM capacity by providing chaperone services to businesses who need assistance, and incentivized adoption through a BIM Fund that covered costs for training, consultants, and more.<sup>20</sup>

Meanwhile, South Korea has demonstrated the role of government in defining a consistent interpretation of code. They translated their national building regulations into machine-readable format with the KBIM initiative; KBimCode is the computer representation of the Korean Building Act, the governing legislation for all construction work in South Korea.<sup>21</sup> Without

Automated plan review software flags objects in the BIM that are causing issues with respect to the building code.

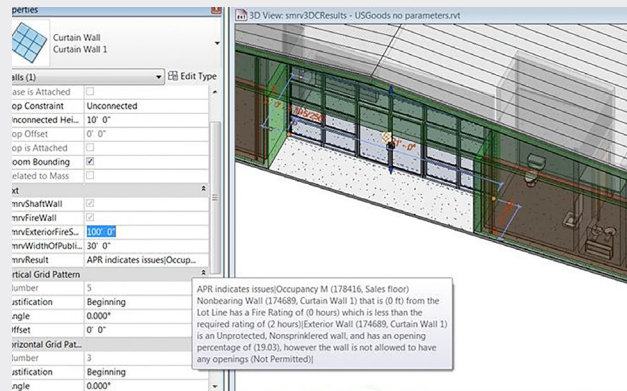


Image credit: Mark Clayton

this rule interpretation, a computer may have building information in BIM, but it cannot judge whether or not a design meets code.

In the United States, no such entity exists. While national entities like the International Code Council (ICC) and the Construction Industry Institute (CII) are in favor of this transition and have completed their own studies on automated code checking,<sup>22</sup> no single entity will ever be in a position to shift the entire United States construction industry. Over the last two decades, the ICC worked on two initiatives towards ACC—SMARTCodes and AUTOCodes—and concluded that standardized guidelines are necessary to align the large variations within BIM modeling practices, and interpretation of code provisions need to be consistent.<sup>23</sup>

New York City’s construction industry is larger than Singapore’s, and its role as the nation’s largest construction market means that it has the ability not only to shape its own practices, but also set the standard that other cities and states will follow. If it were to do so, it could be an advantage to New York-based companies: by making the transition first, they would have an advantage in competing on projects while other jurisdictions make the same transition.

New York City has already done work to standardize BIM documentation. In 2012, the Department of Design + Construction (DDC) published guidelines intended

to ensure conformity in the use of BIM for all public buildings projects.<sup>24</sup> The next year, DOB published BIM guidelines for use in its Site Safety Plans Program, intended to increase safety, hasten approvals, and allow virtual tours.<sup>25</sup>

Further, such a transition would help DOB, FDNY, and other City agencies in their role of ensuring compliance with building codes. The ability of BIM systems to incorporate the codes themselves means they can provide the equivalent of spell-checking to plans—not replacing code review by an experienced plan examiner, but using computer code and machine learning to identify where there are noncompliant aspects of a plan. Just as spell-checking isn't infallible but remains a useful tool for automating trivial tasks, this approach would help both the design professionals and the plan examiners focus their attention on things that are most worthy of their expertise.

## An agenda for the next administration

In order to realize the potential for ACC to improve code compliance, utilize DOB's plan examiners more efficiently, and help New York City's design and construction industry embrace the potential for digital technology, DOB will need to move with determination toward a future in which all permit applications must be submitted in acceptable 3D digital formats that adhere to certain standards. Succeeding in this will require a deft mixture of being willing to push the industry that DOB regulates along with a clear-eyed understanding of what is feasible.

### 1 Enact into law a date certain by which all permit applications will need to be submitted in a new standard BIM format

Forcing a shift of multiple players will require a deadline; no major shift like this will come about in a time frame that is perceived to be reasonable. Instead, there must be a shared sense of urgency driven by a deadline that will seem aggressive but doable. As

a result, the only way to ensure that this transition happens is for the City Council to enact a law establishing a certain date, perhaps 2032, by which all permit applications will need to be submitted in a new and standardized BIM format.

Such legislation could draw from Singapore's head start, embracing many of the features they have identified and built into their CORENET BIM e-submission system as best practices: hassle-free submission with guidelines and clear instructions on how to prepare models and standardization with templates that eases the transition from 2D CAD to 3D BIM.<sup>26</sup>

As with many such legislated shifts, it may make sense for there to be a staggered time frame in which large, complex projects must move first, on the assumption that those working on such projects already have the most sophisticated systems and the resources to change practices first. This approach would also allow smaller projects to move ahead while incorporating lessons and best practices from the larger projects before them.

### 2 Launch a working group to develop a set of universal standards and application programming interfaces (APIs) for BIM files that DOB will accept

Alongside the pursuit of the legislation described above, DOB should establish a working group to develop the standards and APIs that DOB will eventually require. Such a group should include other relevant city agencies, a variety of design and construction firms, and the software companies that develop BIM software.

This effort should seek to draw on experience from several similar efforts worldwide, including Korea's KBIM and Singapore's CORENET-X, as well as two US initiatives: the International Code Council's AutoCodes and the CII's SMART Codes.<sup>27</sup>

### 3 Begin to translate New York City's codes from legal text into computable, machine-readable logic

The most immediate value of ACC to both DOB and the broader design and construction industry is its ability to flag potential code violations in digital documents. This would allow designers to correct them before submission, and also allow DOB to check inbound submissions quickly. Naturally, not all aspects of the code will be susceptible to automated checks; inevitably, judgment will be involved in both design and plan review. But the “spell-check” feature can ensure that expert attention is targeted where it is needed.

This technology and software already exists: for example, Solibri has a model-checking program that automatically checks specific parameters, as do ACABIM and UpCodes AI, among several others.<sup>28</sup>

It will be necessary to develop both the content and the software components to allow these tools to represent New York City's codes. Further, requirements that are currently performance-based should be converted to prescriptive requirements where possible, thus expanding the purview that automated review can address.<sup>29</sup>

Finally, this task will require ensuring as much consistency as possible among the interpretations of DOB's own plan examiners. Industry experts point out that individual examiners can have very different interpretations of the same code.<sup>30</sup> It may be necessary for DOB to work to narrow differences and discretion among its various examiners to make automated code checking work, which would also have the beneficial effect of reducing uncertainty and bringing greater standardization and certainty to code interpretation across the City.

### 4 Start an effort to train the entire AEC industry on BIM

ACC requires rigor from architects and other design professionals to consistently categorize elements within the digital building model so that the software will recognize them correctly.<sup>31</sup> To resolve the steep learning curve required to build up BIM expertise, New York can emulate Singapore's actions: engage with universities and other institutions to offer short courses and specialist certifications (similar to LEED AP or other professional accreditations); establish a dedicated team of chaperones to guide businesses who need assistance in their first BIM project implementation; and introduce a BIM Fund to cover costs for training and consultancy services (similar to New York State Energy Research and Development Authority's incentive programs).

## Privacy and equity concerns

We do not believe that there are significant privacy concerns with this proposal. Detailed building plans are already required by DOB; the greater potential to access these plans remotely if they are submitted in a fully usable electronic form could create a security risk, but this should be surmountable through appropriate data security measures.

We have not identified any equity concerns with this proposal other than the risk that minority and women-owned contractors may in general be smaller companies and thus may face greater difficulties in making this transition than larger companies. To address this, the City should ensure that particular attention is paid to ensure that these companies can make the transition.

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## 3.5 Reduce the number of sidewalk sheds by thoroughly testing how drones can evaluate the safety of building facades

While necessary to protect pedestrians from construction work above, sidewalk sheds blight the streetscape and harm local businesses. A third of all the sidewalk sheds in New York City are erected due to facade inspections, and these are in place for an average of one full year. Radically redesigning the Facade Inspection Safety Program (FISP) to make use of drones can reduce the number of sidewalk sheds in New York City by 15-20%. This process would call for more frequent drone inspections and less frequent physical inspections, with no reduction in the safety of New York's pedestrians. The incoming Mayor should prioritize a rigorous, side-by-side test of how well drones do in evaluating and predicting facade risks compared to the inspections required today.

### The problem we face

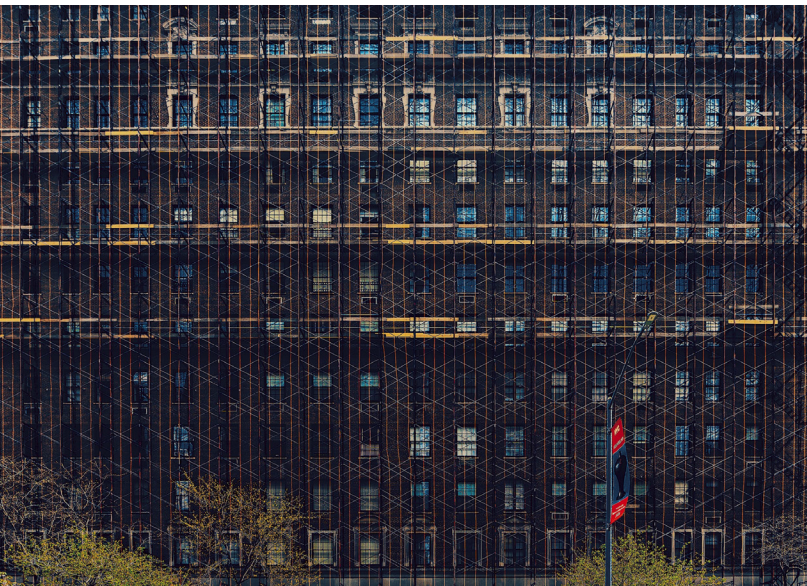
Local Law 11 (LL11) inspections are an important part of keeping New Yorkers safe. Originally enacted in 1980 as a result of the 1979 death of college student Grace Gold, who was killed by falling masonry, the law was updated in 1998 and now mandates that all buildings over six stories undergo a physical facade inspection every five years.<sup>1</sup> Called the Facade Inspection & Safety Program (FISP), the importance of these inspections has been tragically highlighted by the fact that falling masonry continues to kill New Yorkers, as recently as in 2019.<sup>2</sup> Of the approximately 1 million buildings in NYC, more than 14,000 are over six stories and therefore covered under FISP.<sup>3</sup>

FISP inspections consist of several aspects, which have grown more detailed and exhaustive over the years. Currently, street-facing facades must be inspected physically, by inspectors either on scaffolding or rappelling down the side of the building. Facades that do not face a street are inspected visually, usually through binoculars. Every 10 years (or every other 5-year FISP cycle), facades that have cavities must be probed to ensure that the ties holding the facade to the building frame are intact.<sup>4</sup> Still, neither the inspections nor their enforcement have proven to be fail-safe: after a pedestrian was fatally struck by a piece of building facade in 2019, New York City Department of Buildings (DOB) inspectors conducted surprise assessments that determined that 220 other buildings in the City had serious violations that their owners had failed to address.<sup>5</sup>

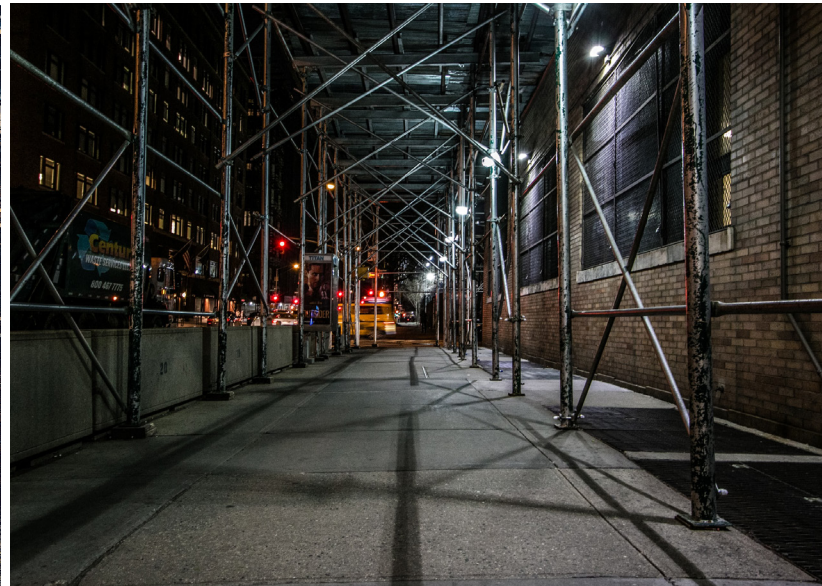
As important as FISP is, the way it currently takes place has a negative impact on life in New York City due to the number of sidewalk sheds it requires. Sidewalk sheds severely diminish the quality of public spaces, reducing retail sales in storefronts underneath scaffolding.<sup>6</sup> For example, the New York City Hospitality Alliance surveyed 79 restaurants in 2016 and found that 40% lost up to a quarter of their revenue when covered by a shed.<sup>7</sup> While most of the City's 9,000 in-place sidewalk sheds (as of March 2021) are due to construction activity, a third of them are due to Local Law 11.<sup>8</sup> Further, these LL11 sheds are in place for a longer period than construction sheds—an average of 349 days for LL11 sheds versus 297 days for construction sheds.<sup>9</sup> Seeking to reduce this duration, DOB imposed a

Although the terms are often used interchangeably, a scaffold (left) is a work platform used to ascend and make repairs, whereas a sidewalk shed (right) is meant to protect pedestrians from falling debris.

Photo credit: Clay LeConey, Zachary Shakked.



“Sidewalk sheds severely diminish the quality of public spaces, reducing retail sales in storefronts underneath scaffolding.”



new rule in 2020 to require that building owners correct unsafe conditions within 90 days.<sup>10</sup> The extent to which this is enforced, or even possible, remains to be seen.

## The technology opportunity

Drone technology may offer a way to maintain and even enhance the safety benefits of LL11 while reducing its negative impacts. Drones are increasingly being used for infrastructure inspections, among many other applications.<sup>11</sup> It is not clear that drones today are capable of making repairs, although such technology is imaginable in the future.

The immediate, obvious use of drones is to conduct a detailed, close-up visual inspection of building facades. Because drones can fly precisely programmed flight paths, they can piece together a perfect, high-resolution image of an entire building at close range, thus eliminating the need for human inspectors to climb scaffolding or rappel down facades. A drone inspection would create thousands of images which would be analyzed by software that identifies potential defects

and flags them for review by an engineer.<sup>12</sup> This software already exists and is widely used for inspections of bridges, construction sites, industrial plants, and other infrastructure.<sup>13</sup>

In addition, the precise imaging supplied by drones enables other analyses that the human eye cannot make. First, detailed images can be used to create three-dimensional maps or diagrams that are extremely precise. Two such images taken at different times can be automatically compared to highlight where differences exist—which would flag, for example, where a brick might have shifted by even a millimeter. Further, drones can use other forms of imaging to “see inside” a structure: for example, infrared thermography can detect heat signatures that may be indicative of compromised structural elements, and forward-looking infrared radar can identify minute gas leaks.<sup>14</sup>

There is reason to believe that the use of drones for FISP inspections can significantly reduce the incidence of sidewalk sheds and the costs related to them that building owners face. In the last two five-year FISP cycles, roughly half of all buildings passed inspection



with a “safe” rating, meaning no repairs were indicated by the inspection.<sup>15</sup> If drone inspections could discern buildings with no risks, they could immediately cut the number of sidewalk sheds caused by FISP inspections by 50%—or a 15% reduction in sheds citywide. In the remaining buildings that require further inspection and repair, it is often the case that only one section or side of the building requires attention; this could cut the FISP-related sidewalk sheds by another 10-25%.<sup>16</sup> All told, it is possible that drones could reduce the number of sidewalk sheds by 15-20%.

It is likely that drone inspections will take dramatically less time and cost significantly less money than physical inspections, especially for tall buildings. Short buildings are already relatively inexpensive to inspect, with a cost estimated at \$10,000.<sup>17</sup> But the inspection of taller buildings can run upwards of \$100,000 using traditional scaffolding. One firm estimated that a six-story building could be inspected at a 30% cost reduction.<sup>18</sup>

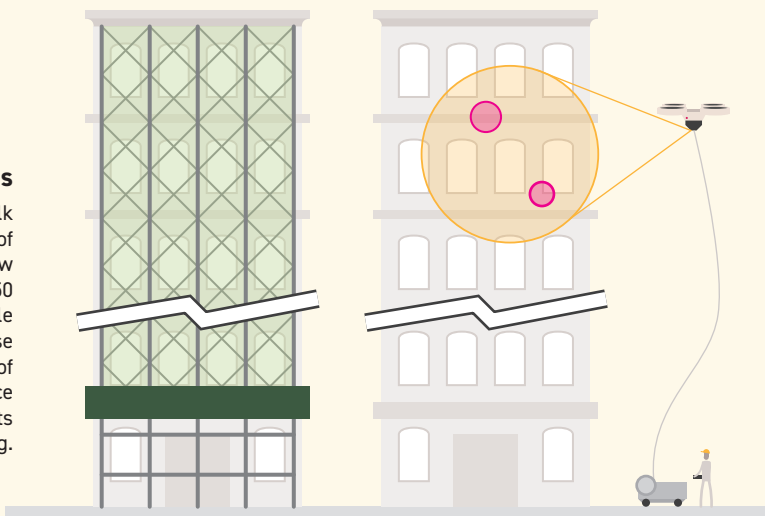
The promise of drone inspections led the City Council to enact Local Law 102 of 2020, which mandates that DOB study the potential for facade inspections to be conducted by drone.<sup>19</sup> The results of the study were published late in 2021, and we discuss them below.

Two concerns have been raised about using drones for facade inspections. The first is a general concern about the use of drones in New York City. Technically, drones are currently banned citywide. A 1948 law<sup>20</sup> and Administrative Code §10-126[c]<sup>21</sup> prohibits aircrafts from taking off and landing anywhere that isn’t designated by the City’s Department of Transportation (DOT) or the Port Authority, like airports and heliports, in spite of the 2016 rule from the Federal Aviation Administration (FAA)<sup>22</sup> that legalized commercial drone use.<sup>23</sup> This is due to the risk of drones potentially causing damage to structures (intentionally or unintentionally), colliding with other aircraft, or harming people on the City’s crowded sidewalks.<sup>24</sup> Further, the New York Police Department (NYPD) has long been concerned about the inability to identify the owner or operator of a drone and to stop a drone that is acting maliciously or negli-

“If drone inspections could discern buildings with no risks, they could immediately cut the number of sidewalk sheds caused by FISP inspections by 50%—or a 15% reduction in sheds citywide.”

**Sidewalk Sheds**

Of some 9,000 sidewalk sheds in the city, a third of them are due to Local Law 11 and are in place for 350 days on average. While important for safety, these diminish the quality of public spaces and reduce retail sales in storefronts underneath scaffolding.



**Drone Imaging**

Drones can help speed up the inspection and repair process, eliminating the need for widespread scaffolding and instead highlighting the specific locations that need repair access.

Fault-detection software can flag any deviations from 3D models that drones can develop, resulting in quicker visual inspections of facades and faster repairs.



Image credit: Helios Visions / heliosvisions.com.

Drones can use thermal imaging to detect heat signatures that may be indicative of compromised structural elements.

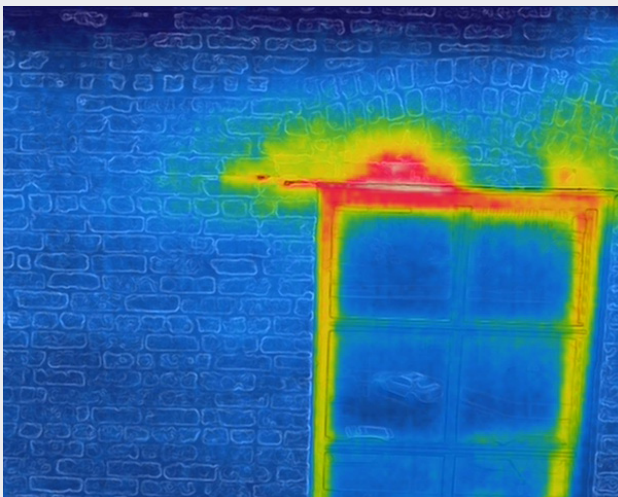


Image credit: Helios Visions / heliosvisions.com.

gently. While the FAA is working on rules that would help clarify this situation,<sup>25</sup> it is unlikely that New York City will ever be an easy place for free-flying drone use.

However, one solution to this challenge is to use tethered drones. More common in military and communications applications, tethered drones use a ground-based power supply to allow long-duration flights in a small area. With cords that reach 300 feet, tethered drones could easily be used for facade inspections of buildings as high as 20 or 25 stories, and could also likely be launched from the top of buildings and fly downwards, to serve even taller buildings. Because they are tethered, such drones cannot fly away, and it would be immediately obvious where the drone is based, who is controlling it, and how it could be brought down if necessary.<sup>26</sup>

It is not clear whether tethered drones will be assessed in the DOB study, but their potential means that drone facade inspections need not wait for an overall solution to the question of how to manage free-flying drones in New York City.

The second concern is that drones cannot conduct all of the inspections required by FISP, so a drone-conducted visual inspection alone is not enough to comply with the law. In 2019, one DOB official voiced this opinion, stating that, “nothing is going to replace a hands-on inspection.”<sup>27</sup>

However, making full use of drones—as is true for many technologies—requires thinking about them not as a direct substitute for a current, human-based task, but rather as a different way to achieve the outcome. Thus, drone inspections should be considered a new tool that allows the objectives of LL11 to be met and achieved in entirely new ways. It is possible that precise 3D maps and infrared scanning could be even more useful at predicting failures than the periodic inspections DOB currently requires, especially when coupled with machine learning software that is fed a strong enough dataset. The lower cost of drone-based inspections could also allow more frequent inspections, the results of which could be automatically compared to previous inspections to check for changes that might be indicative of a future failure. It is also possible to imagine a requirement that 3D facade models be submitted to DOB for its own analysis, including poten-

“Making full use of drones—as is true for many technologies—requires thinking about them not as a direct substitute for a current, human-based task, but rather as a different way to achieve the outcome. Thus, drone inspections should be considered a new tool that allows the objectives of LL11 to be met and achieved in entirely new ways.”

tially making them open-source data subject to public scrutiny—an approach that might draw attention to riskier buildings before they cause injury or deaths.

While the Council-mandated DOB study is an important start and will no doubt raise important issues that need to be addressed, it is likely only a beginning. A full exploration of the potential for drone-based facade inspections would require a significant commitment of time and effort, not only from DOB but from the real estate and construction industries.

A potential approach would be to use tethered drones alongside a set of traditional inspections being done in 2022 or 2023. In this approach, DOB could identify buildings that are due for their inspections and pay for a parallel drone inspection to be undertaken at the same time as the traditional inspection. This would create a dataset about drone inspection efficacy that could be compared to the results of the traditional inspections. If, for example, the drones missed issues that were identified by physical inspections, such as soundings or probings, that would demonstrate that the drones’ capabilities could not obviate the need for human inspections. On the other hand, if drone-based 3D mapping and thermal inspections did identify all

risks that human inspectors found—and also if they identified more that proved to be real risks—this would indicate that drones can do different inspections but lead to the same or better level of safety. Overall, this is less an assessment of whether drones can be used, and more about the different mix of inspections and how they each contribute to identifying the real safety risks in facades.

Such a study would also quantify the number of buildings where inspections successfully identified necessary repairs, and how many of those were targeted enough to allow for partial sidewalk sheds instead of sidewalk sheds along the entire facade. If drone-based inspections can cut sidewalk shed length or duration, that would be a meaningful contribution to improving New York City’s streetscape.

## An agenda for the next administration

Just at the end of the revision process for this final report, on November 24, 2021, DOB released its long-awaited drone study. That report concluded that drones are unlikely to play a significant role in facade inspections in the future. The DOB report acknowledged that drones offer certain advantages, but found they would not achieve significant benefits in two key areas: reducing costs and identifying risks more accurately. The DOB analysis of both of these areas suffered from flawed comparisons, however:

- **Cost reductions:** The DOB study attempts to assess drones’ potential to reduce the cost of an LL11 inspection by analyzing a set of proposals delivered to the New York City Housing Authority (NYCHA), and then comparing those with a separate set of informal proposals received from drone companies. Unfortunately, DOB did not actually work with NYCHA to undertake a real solicitation from multiple parties at the same time, under the same conditions. Further, DOB’s analysis discounts the low prices cited by the drone-only companies. As a result, DOB’s conclusion that drones would not reduce the price of an inspection is based on a highly flawed set of information and should not be relied upon.

- **Machine learning photograph analysis:** The DOB team did one side-by-side analysis of machine learning photo analysis, but acknowledged that it provided photos to the analysis firm that did not allow that firm to create orthomosaics, as is their standard practice. Further, the photos provided were admittedly taken in a different season and under different lighting conditions than the traditional inspection performed by the control team.

Under these conditions, it does not seem like innovation was given a reasonable test in DOB's report. While its overall message that drones are not a panacea is correct, the study neither gave drones a legitimate side-by-side analytical comparison with traditional techniques, nor did it fully explore the potential for drones to do more than just visual data collection. Further, while the report concludes with some ideas for further study, it fails to outline any clear plan for DOB to undertake that research.<sup>28</sup>

Building on this report, the next Mayor should undertake a meaningful effort to evaluate drone-based inspections early in their administration. DOB will not have had the time or resources to undertake the kind of analysis that would be definitive, so its report should be followed by a full-scale study, incorporating whatever DOB concludes into a work plan that resembles the following:

## 1 Issue a Request for Information (RFI) to see what the private sector proposes as a drone-based solution to facade inspection requirements

DOB should issue an RFI to facade inspection and drone companies to understand the range of technologies available, both with respect to the security issues related to the drones themselves (and the potential for tethering) and the kinds of inspections that drones can perform. Rather than reiterate the kinds of inspections that are currently required, DOB should specify the risks that FISP requirements are designed to address, and ask the industry how it would use drone-based technology to identify those risks. This RFI should

be issued no later than June 1, 2022, and it should be preceded by a bidders' conference that would allow the manufacturers of tethered drones to meet the companies that already conduct building and infrastructure inspections with untethered drones, as the combination of those two technologies is a somewhat New York City-specific need.

## 2 Conduct a thorough, side-by-side test of human and drone-based inspections of a sizable sample of the buildings that must undertake facade inspections in 2023

By September 1, 2022, DOB should lay out a drone-based facade inspection pilot program for 2023. This will include identifying the buildings that would be included in the test, the kinds of inspections that drones will undertake, the tethering and other security requirements and protocols that will be imposed, and the way that results will be analyzed. The City will likely need to pay for the drone inspections, while the building owners (as per usual) will pay for the costs of the traditional inspections. DOB should identify a partner, either an engineering firm or a university, to analyze the results and determine their effectiveness. It is possible that donors or the construction industry could contribute to the cost of the tests.

The pilot would take place during 2023, and the analysis of the results should be done on a rolling basis, so emerging hypotheses can be evaluated with further data and, potentially, so that the specifics of the drone inspections evolve to address any shortcomings. It should be feasible to have a final analysis no later than March 1, 2024.

### 3 Based on the results, incorporate these results into a revised approach to facade inspection starting in 2025

Based on the results of the 2023 pilot, DOB should develop a new set of FISP requirements that should be able to begin with the 2025 inspection year. It will be important for DOB to convene outside experts—both within New York and ideally including participation from national and international experts who may be more impartial—in order to ensure that they are fully open to both the potential and the shortcomings of the new technology. A prominent consulting firm or research university could also objectively undertake the analysis of the results. If drones prove to be a worthwhile addition to the FISP program, it likely will be in the context of a broader redefinition of the requirements, rather than a direct substitute of current requirements.

The bulk of this work falls squarely within the DOB, but will also require mayoral leadership to ensure that the NYPD and DOT accept the use of tethered drones, and thoughtful (but not overly onerous) rules are created to ensure that such drones are operated safely. Further, both temporary drone permissions and permanent changes to FISP may require City Council approval.

The cost of a large-scale pilot program is likely to run up to \$10 million. If we assume that a drone inspection of the average building costs \$10,000, and we target a quarter of the roughly 3,000 buildings that are up for FISP inspections in 2023, that leads to a total cost of \$7-8 million.<sup>29</sup> If we add \$2 million for project management, analysis by a consulting firm or research university, and contingencies, we reach a total of roughly \$10 million.

## Privacy and equity concerns

There are obvious privacy concerns with drones that are regularly scanning building facades, because they can see inside apartment windows. However, this is a fairly easy concern to mitigate. First, there are several types of software readily available to obscure portions of photos or scans, such as the one used by Google

Maps that obscures the faces of people captured in its images.<sup>30</sup> Second, building owners could be required to notify residents of the time frame in which drones will be scanning the building, and thus allow residents the option of drawing blinds or curtains during that period. Finally, the original photos should be considered personally identifiable information collected in the public realm under the rule outlined in our Privacy chapter (1.1), and thus the holder of the data—whether private or public—would be required to turn it over to the NYPD or any other law enforcement agency only by warrant, and prohibited from selling or sharing it with any third party.

To date, we have not identified any equity concerns with this initiative.

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## 3.6 Improve sanitation efficiency by upgrading waste management technology

Solid waste is one of the City's top environmental concerns, and certainly one of the most visible; garbage is an unwelcome presence on nearly every sidewalk and street in New York at one time or another.<sup>1</sup> In a city of 8.8 million, it's no surprise that there's a lot of trash. But the volume of waste is not the only issue. It's exacerbated by the fact that our solid waste management systems still rely primarily on technologies that date back to the 1970s. We dispose of our trash in plastic bags that are set out by the curb, then load them by hand into noisy hydraulic trucks, almost all of which are powered by fossil fuels. The waste next is transferred to distant landfills or incinerators, which present enormous environmental issues in their own right. These static technologies have not evolved in the last four decades. In the 21st century, new solutions exist that could create a more efficient, sustainable, and dynamic end-to-end sanitation system—from waste generation to storage to collection to disposal. A tech-enhanced approach will help New York City achieve a speedier and more efficient solid-waste solution, resulting in cleaner streets, clearer sidewalks, fewer rats and bugs, less noise, less physical stress on workers, and lower rates of particulate pollution.

### The problem we face

Anyone who has ever spent much time in New York has seen the way mounting piles of trash spill out across the City's streets and sidewalks, interfering with walking, cycling, and other activities.<sup>2</sup> Business owners are affected by the unsightly mess and vermin outside their doors; diesel-powered trucks add to the

pollution that all of us must breathe and the noise we must all endure; and the City's budget strains under the cost of collecting this enormous volume of waste using antiquated methods. The COVID-19 pandemic has only increased the City's solid-waste challenges, with residents generating more trash than ever at home, even as labor shortages have hit the Department of Sanitation of New York (DSNY).<sup>3</sup>

There are three main weaknesses in the City's overall waste-management approach, which must be solved in tandem:

#### Too much waste going to landfill

The first and most fundamental is that New York City generates a lot of waste—4 million tons per year—and, crucially, that almost all of it gets transported to landfill.<sup>4</sup> City residents actually don't produce more garbage than most Americans on a per capita basis. The average New Yorker throws out about 2.5 pounds of trash per day, much less than the 4.4 pounds per day the typical American disposes of, and more in line with norms in the United Kingdom (about 2.5 pounds of garbage per person per day) or the Netherlands (about 3 pounds).<sup>5</sup> But because of the number of people who live in New York, sheer volume remains a problem, one that is only exacerbated by the fact that virtually all of this waste is sent off to landfills, incinerators, and recycling facilities.

We also fail to recycle enough of our waste. Despite 25 years of effort, New York's recycling rate has been fairly stagnant at 18% of residential waste.<sup>6</sup> San Francisco, by contrast, redirects almost 80 percent of its refuse away

New York City still collects trash using systems that haven't changed much for decades.



1973

Photo credit: Wikimedia Commons / Gary Miller.



2016

Photo Credit: Shutterstock / BrandonKleinPhoto.

from landfills (including construction waste).<sup>7</sup> They accomplish this through an aggressive combination of recycling and organics collection, including mandatory recycling and composting, as well as penalties for businesses that fail to separate their trash. As a result, while San Francisco's residents generate about 7 pounds per capita per day—nearly three times what the average New Yorker generates—they only send 2.7 pounds each to landfill.<sup>8, 9</sup>

Trucking the vast majority of New York's waste to sorting facilities, and then shipping it to landfills and incinerators is an expensive proposition. In fiscal year 2020, the City paid \$430 million for "waste export," including the cost of transport to and disposal in landfills, and has funded \$424.7 million for the same purpose in fiscal year 2022. Collection costs are even higher, about \$800 million per year.<sup>10</sup> And it isn't only City government that gets hit hard by the cost of garbage collection—under City law, businesses must pay private haulers for garbage collection. (New York has a two-part waste collection system: residential waste collection is the responsibility of DSNY, at no cost to City residents, while commercial waste collection is performed by private haulers contracted by businesses and is not under direct DSNY supervision.) Smaller businesses typically have to pay more on average per cubic yard of waste than larger customers. This is concerning from an equity standpoint, because smaller businesses get charged more for producing less waste, while larger businesses pay lower unit prices—not in spite of, but because of their higher volumes of trash.<sup>11</sup>

Waste transport by truck also creates significant negative externalities in terms of carbon emissions, noise and congestion on streets, and street safety.

### Sidewalk trash storage

The second fundamental problem in the City's waste management approach is its reliance on using sidewalks as storage space for residential and commercial garbage awaiting pickup. Piles of trash sit at the curb for hours and days at a time, resulting in messy and obstructed streets that are especially difficult to navigate for people with disabilities or those who are pushing strollers or making deliveries. Sanitation workers, who work at the sixth-deadliest occupation in the United States, risk injury when hauling bags and larger items from the curb and



throwing them into trucks.<sup>12</sup> In addition, because New York City does not mandate separation of organic waste, trash bags set out for collection are full of decomposing organic matter and tend to leak, making for an unpleasant sidewalk experience and also attracting rats (a chronic scourge that has only gotten worse with the rise of outdoor dining).<sup>13</sup> While many of these issues can be attributed to the ever-increasing amount of trash that New York's residents produce, the more fundamental problem lies in the absence of a containerized waste system—something that major U.S. cities like San Francisco, Seattle, and Chicago already have.

### Inefficiency

The third essential problem with the City's treatment and transport of waste is collection inefficiency. DSNY's municipal fleet includes 2,100 collection trucks and 300 front-loader trucks, most of which have GPS technology that allows dispatchers to locate them at any point in time.<sup>14</sup> However, the City does not use that capability to implement turn-by-turn routing because it doesn't have dynamic data about garbage awaiting collection. As a result, the City's garbage trucks move on fixed routes regardless of how much garbage is out for pickup along the way, resulting in some trucks overflowing with trash while others go back to the depot half-full. DSNY trucks stop in front of every residential building in the City multiple times a week for collection and compaction, logging about 25 million miles a year in total and burning some 5 million gallons of diesel fuel.<sup>15</sup> The result is increased emissions, congestion and unsafe conditions on our streets. Diesel truck emissions contribute to a chronic asthma problem in the city that disproportionately affects lower-income and nonwhite communities.<sup>16</sup> Land-based waste transfer facilities are often located in communities that are heavily polluted from industrial and commercial use, such as Hunts Point in the Bronx, where some 30 percent of children in neighborhood schools in Hunts Point suffer from asthma.<sup>17</sup> The trucks are noisy, too, subjecting workers to decibel levels in excess of 90db over eight hours, the standard set by the Occupational Safety & Health Administration (OSHA), levels that can cause hearing loss.<sup>18</sup> New Yorkers file more complaints about garbage truck noise than about any other form of noise pollution.<sup>19</sup>

“New York's fundamental waste problem lies in the absence of a containerized waste system—something many major U.S. cities already have.”

Further, because DSNY data consists of aggregate volumes based on sanitation districts rather than the more granular block-by-block or even household-by-household measurements, it cannot respond to residents' needs with precision and maximum efficiency. Currently, the department relies on 311 calls to learn about problems as they arise, but this is a scattershot approach that fails to address the underlying inefficiencies.

### DSNY and technology

In some parts of its operations, DSNY has made significant progress in using technology. The BladeRunner program, for instance, was developed in 2014 to improve DSNY's snow-removal services—another function served by the department's trucks—by enhancing existing GPS technology and enabling DSNY field workers and supervisors to communicate about where service is needed.<sup>20</sup> The department is piloting the use of electric trucks in its fleet.<sup>21</sup> And DSNY is also now experimenting with direct, targeted messaging via text and email to residents who have signed up for curbside collection of organics, thus beginning to develop a “customer” relationship with the city's residents.

Additionally, the City is rolling out a Commercial Waste Zones initiative, which divides the city into 20 districts and requires private carters bidding to operate in those areas to meet certain standards of safety, labor conditions, and customer service. This will help to make the chronically troubled commercial hauling system more accountable; reduce truck traffic from commercial waste hauling; and improve public safety.<sup>22 23</sup> This same initiative will help develop a robust data system to manage and digitize the data that is required of these haulers, overcoming some of the inefficiencies and safety concerns with commercial hauling.

Most significantly, DSNY demonstrated a major systems shift over the last 25 years with the creation of the residential recycling program. This not only included new rules for residents to separate their waste, but also involved purchasing new trucks, and creating two new facilities, to sort mixed recyclables (metal, glass, and plastic) and to reprocess recycled paper into cardboard boxes. In a meaningful way, recycling relies on new technologies that allow the cost-effective sorting of waste into pure streams of materials that can be reused.<sup>24</sup> And, while the City’s on-and-off curbside composting program has been much criticized,<sup>25</sup> DSNY is now attempting to test new technology to divert organic waste from landfills, recently installing “Smart Bins”<sup>26</sup> as round-the-clock drop-off locations for food and yard scraps in certain areas.<sup>27</sup>

While these initiatives are a step in the right direction, the City still needs to adopt technology much more rapidly and at a systems level across the board in the waste management lifecycle.

## The technology opportunity

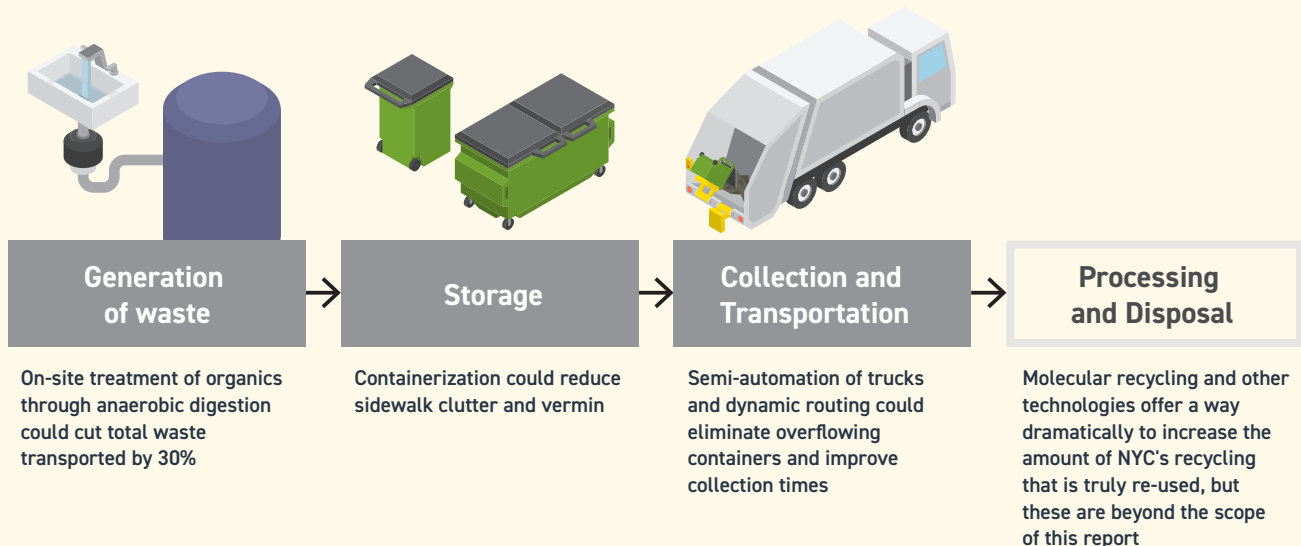
Over the last decade, waste-management technologies have been advancing rapidly, and tech solutions to many of New York City’s sanitation problems now exist. The challenge is in deployment. The City has for a long time relied on a piecemeal approach instead of a comprehensive systems approach to waste management technology, which has resulted in solving specific pieces of the problem without enabling systemic change all the way from waste generation to disposal. In addition, this scattershot approach has resulted in some miscalculations for future investments in new technologies.

Our research has identified three systems through which technology can transform the way we manage solid waste in the City, beginning with handling more waste on the location where it is generated and following through to make the storage and collection processes more efficient.

### Small-scale anaerobic digestion

The best way to reduce the enormous volume of refuse New York transports to landfill—aside from not generating it at all—would be to process at least some of it in the same buildings where it is generated. That option

### How technology could transform NYC’s waste handling



has mostly been off-limits to New Yorkers since incineration in apartment buildings was banned in 1989.<sup>28</sup> But new advances in technology hold out the promise of processing a significant amount of the City's organic waste—which represents one-third of the flow that gets sent to landfills today—in small-scale anaerobic digestion (AD) units in commercial buildings and multifamily dwellings. For a long time, the high cost of anaerobic digesters meant the only option was to set up large-scale iterations, such as the massive Digester Eggs at the Newtown Creek Wastewater Plant, operated by the City's Department of Environmental Protection (DEP). However, AD is now becoming available at relatively low capital and operational costs, and could be deployed at scale at the household, business, or neighborhood level.<sup>29</sup> Using this technology in the City could enable the diversion of food waste, at scale, from restaurants, schools, hotels, and apartment buildings.

Anaerobic digestion is the process of breaking down organic waste material with microorganisms in a sealed vessel that does not admit oxygen (hence “anaerobic”). The resulting products of this process are biogas (which can be harnessed for energy), soil, and water. This technology has existed for a long time, but only now has it been miniaturized to the point where it could be implemented at the apartment building or single-family home scale—a potentially game-changing development. Widespread on-site AD adoption could reduce the overall amount of waste hauled in New York City by more than 30 percent, with the potential for an equal reduction in truck miles, tipping fees, and rotting garbage stored on the street.

AD takes place in sealed vessels which are designed in various shapes and sizes specific to each site. Smaller digesters, between 2 and 10 cubic meters, can power a single household for up to 12 hours per day with the biogas they generate; larger ones, in the 50-cubic-meter range, can power entire communities for up to 250 hours by linking to local grids.<sup>30</sup> Small-scale anaerobic digestion would thus not only help cut costs and decrease inefficiencies in waste transportation, but it would also help residents and businesses turn waste into renewable energy and get the City closer to its OneNYC plan of sending zero waste to landfill by 2030.<sup>31</sup>

Providers of AD technology are emerging in the consumer market. One such company is HomeBiogas, which has worked to install on-site small-scale solutions for a number of businesses and homes in Israel, South Asia, Africa, and now the United States. These systems allow businesses and commercial establishments to turn their waste into heat and hot water while also benefiting from the bio-fertilizers that the systems generate. As an example, an AD unit helped Hadasa Neurim Youth Village in Israel, home to some 300 students, to cut its waste collection costs in half and to replace electricity from the grid with biogas-powered electricity.<sup>32</sup> HomeBiogas has installed a number of smaller anaerobic digesters in single-family homes and is also piloting these systems in some multifamily homes.<sup>33</sup>

AD is not the only tech that enables on-site processing of organic waste. In 2016 New York City began piloting systems called ORCAs, which decompose waste aerobically (in the presence of oxygen), at several business locations.<sup>34</sup> The ORCAs turn waste into water that is then fed into the sewage system. While they do not offer the same energy benefits of AD, as they require some electricity to operate, they have the advantage of having been tested within the City's very specific and rigid space constraints.<sup>35</sup> ORCAs thus represent an opportunity for hotels, supermarkets, and similar businesses across the City to handle their organic waste on-site before it hits the streets.

Integrating AD into the New York landscape will require a thorough review of relevant safety and code considerations by the Department of Buildings (DOB), the New York City Fire Department (FDNY), and the DEP. These should be manageable challenges, as AD systems are already engineered to prevent fire, gas leakage, or explosion.<sup>36</sup>

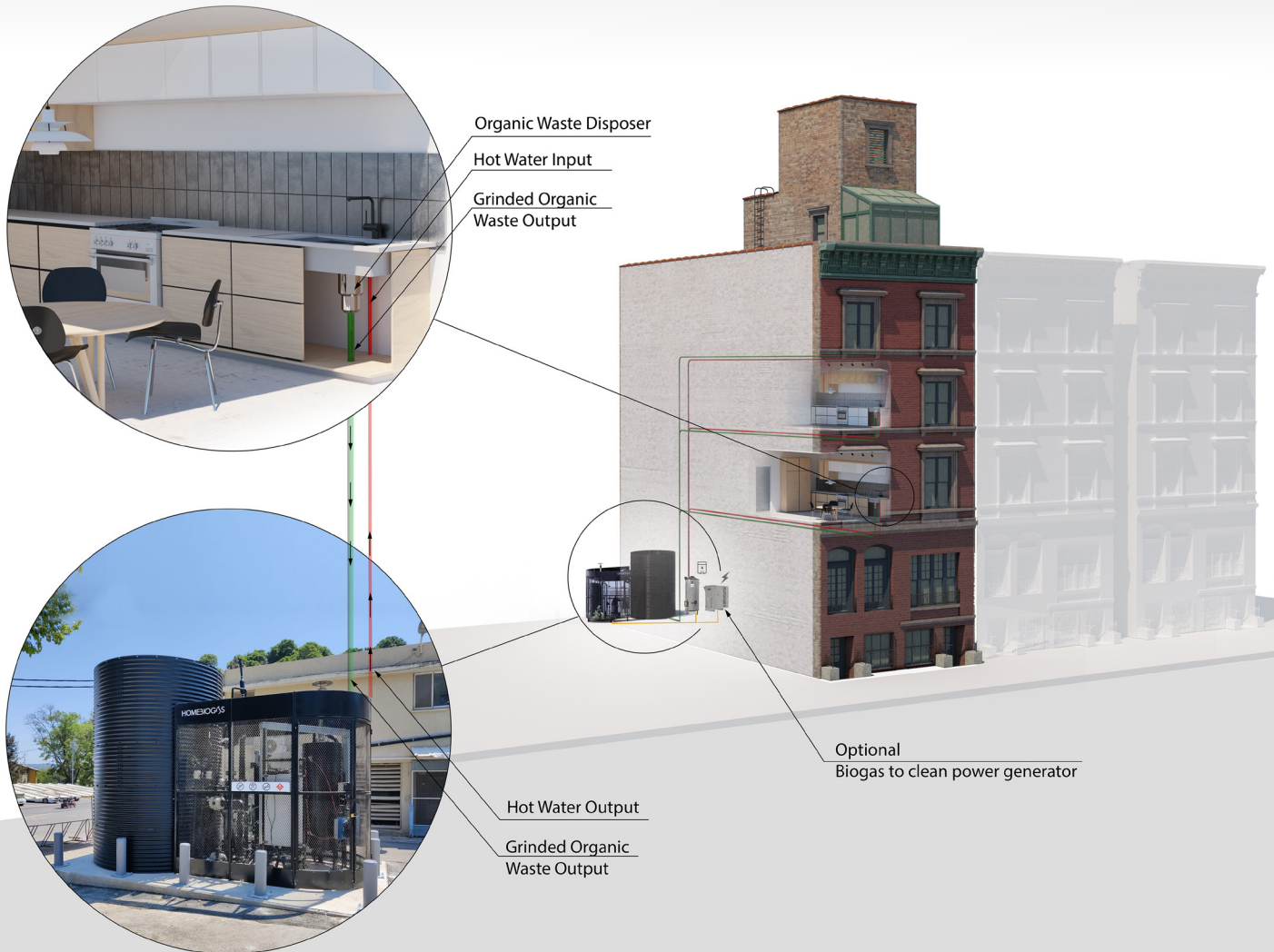
### Containerization and semi-automated trucks

The second technology opportunity identified by our research is the containerization of waste and semi-automation of pickup, particularly at multifamily residential buildings. Currently, New York City relies on an outdated system for trash collection at its many apartment buildings. Superintendents and other maintenance workers put trash into plastic bags and set out at the curb for pickup by DSNY workers, who then throw the bags into trucks for compaction. It is

## Anaerobic digestion

New developments in anaerobic digestion (AD) technology mean that this solution will become viable for homes and businesses in urban environments in the near future. The biogas produced by AD could be used to heat water or generate electricity.

Image credit: HomeBiogas.



a time-consuming, messy, and dangerous process, and most cities have left it behind, adopting a combination of containers and automated trucks.

Recently, New York City adopted a rule to require certain buildings to submit a waste management plan, including a storage plan for an estimated amount of source-separated waste, as well as a plan for how and where the generated waste will be placed for collection without obstructing the sidewalk or interfering with pedestrian flow.<sup>37</sup> While this is a big step towards regulating waste flows from large buildings, the City has done almost nothing to move towards containerization in either residential or commercial settings. The Clean Curbs program, which aims to encourage Business Improvement Districts (BIDs) and other private entities to move toward secure on-street containers for their trash and recycling storage, received a lot of attention when it was announced in 2020, but two years later it has yet to result in any actual containers on the street.<sup>38</sup> Even the most well-funded BIDs have little incentive to take on the cost of designing and prototyping such containers, as the program requires, because the resulting cost savings in commercial hauling fees do not offset the outlay required.<sup>39</sup>

In the residential sphere, where DSNY has full control over collections, the opportunity is clearer than it is in the commercial space. And there are countless examples of cities that are currently using containers for residential trash collection, paired with semi- or fully automated truck hoists that lift the containers and dump the trash into trucks. Phoenix was the first to introduce automated side-loader collection vehicles to their fleet in the 1970s, with the aim of minimizing injuries from waste collection.<sup>40</sup> Chicago began using semi-automated trucks because of a rat infestation in the 1980s.<sup>41</sup> Barcelona, like many cities in Europe, South America, and Asia, has installed sealed, midblock, curbside containers to centralize residential trash collection.<sup>42</sup> Much like New York City, The Hague, which is the third-largest city in the Netherlands, used to do door-to-door collection of refuse bags or collection from wheeled bins—attracting seagulls, which pecked through the bags and strewed waste in the streets. In 2009, the city replaced bags with underground shared

Containers, together with semi-automated trucks, can help enhance collection efficiency and improve worker safety.



Photo credit: Center for Zero Waste Design.

containers, significantly improving street cleanliness while also improving working conditions for the sanitation workers and reducing labor costs.<sup>43</sup>

While there are limits to the types of approaches to containerization that could feasibly be implemented in New York—underground solutions are complicated by the tangle of infrastructure beneath the City pavement—others are well within our reach. We should, as was proposed by DSNY in 2020,<sup>44</sup> require large apartment buildings to put their separated waste in containers, and to upgrade DSNY collection trucks with hoists that are compatible with those

containers—or to purchase new trucks with semi- or fully automated technology that makes them capable of semi-automated container pickup.<sup>45</sup>

The New York–based nonprofit Center for Zero Waste Design, in its Zero Waste Design Guidelines, provides a comprehensive resource outlining how buildings and public spaces could be designed to enable zero-waste operations. It describes different types and sizes of containers, along with considerations of access for the trucks required to empty them.<sup>46</sup> These typologies include rear-end loader containers with a capacity of between 1 and 8 cubic yards, as well as Roll-on/Roll-off containers that can hold up to 40 cubic yards.<sup>47</sup> Any of these containers would give multifamily buildings a better way to manage waste than the current system of piled plastic bags, and would reduce injuries to DSNY workers. New buildings should be designed to allow for use of containers, including curb cuts and loading areas for trucks to stop for collection.

In New York City, as in other dense cities, most building types and access configurations would require that wheeled bins or containers be brought out to a truck for semi-automated collection; the alternative is to deploy fixed containers in the street, as is done in Barcelona.<sup>48</sup> Any new DSNY trucks would have to be compatible with these containers in order for the system to work. This may have implications for DSNY's fleet: because DSNY is responsible not only for picking up the City's trash, but also for plowing the streets when it snows, it currently buys trucks that can do both. However, front-loading trucks cannot serve as snow plows.<sup>49</sup> For this reason, rear-loading trucks would need to be considered, or DSNY could consider having two dedicated fleets, one for daily garbage collection, and one for plows. Because plows are only used a few days out of the year, it may be possible to extend the life of the current fleet for a long time if they are only used as plows. Or it may be more cost-effective to buy dedicated trucks that are specifically designed as plows.

For larger residential complexes with appropriate configurations, Roll-on/Roll-off containers can be used. These 20-40 cubic yard containers are designed to be loaded directly onto the flatbed of a truck in a fully automated process; they then require a dedicated trip to the transfer facility. "RoRos," as they are known, are typically used by large commercial, mixed-use, and

institutional buildings. DSNY has implemented RoRo compactor containers at some NYCHA facilities,<sup>50</sup> and the Battery Park City Alliance also installed shared RoRo compactors for trash<sup>51</sup> in the high-rise community of Battery Park City in Lower Manhattan. That multi-building complex, with some 14,000 residents, transitioned from door-to-door pickup of refuse bags to consolidated collection in compactor containers—a move that not only reduced vermin but also proved popular among building staff.<sup>52</sup>

It is important to note that this technology will not take jobs away from sanitation workers. Instead it will empower them to do their jobs safely. Container-hoisting trucks eliminate heavy lifting and direct contact with garbage, allowing crews to focus on driving and to pick up more refuse over the course of a shift with less physical effort or risk. Given DSNY's snow-removal responsibility, a full shift to automated trucks will require either designing such trucks to be robust enough to serve as plows, or the maintenance of a separate fleet of purpose-designed plows for winter emergencies. If garbage trucks are dedicated to garbage pickup rather than being pressed into service periodically as snow plows, they could also be much smaller than the heavy trucks currently used for collection. These smaller trucks would be safer for workers and the public alike, and could be easily electrified.

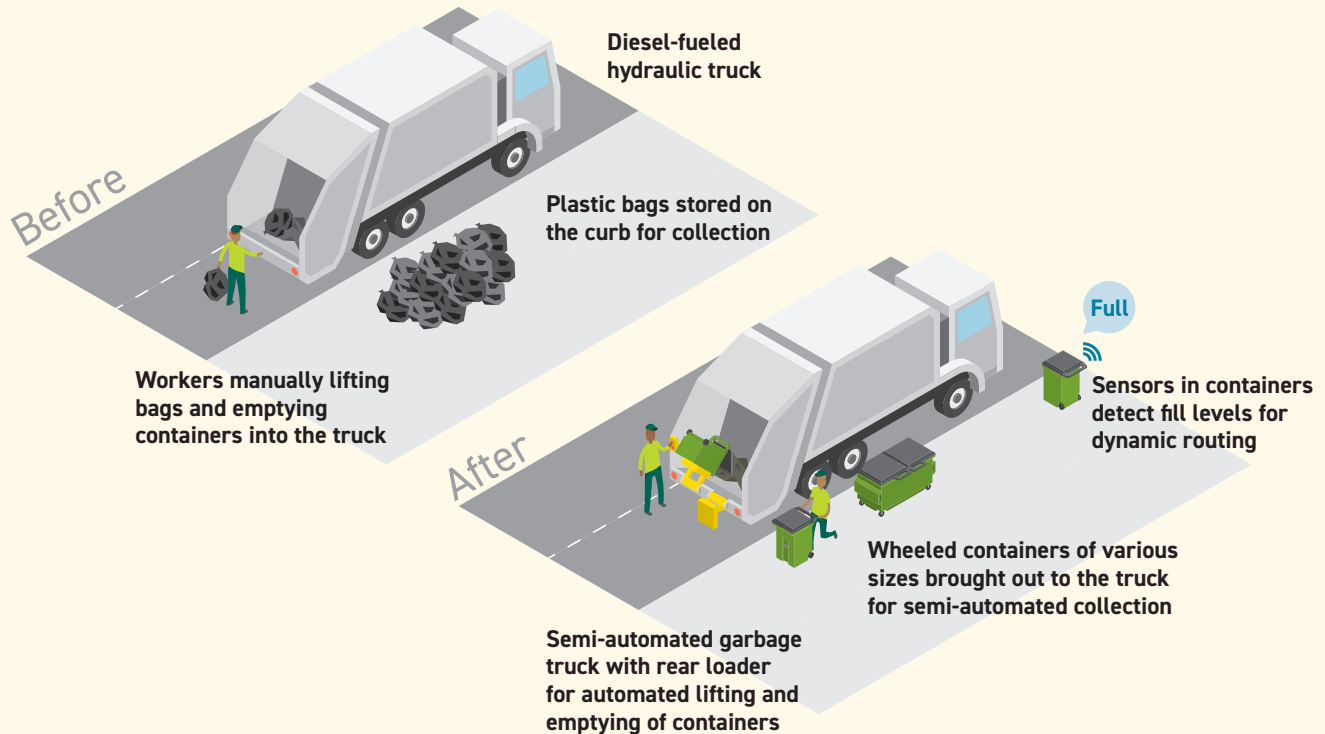
### Fully digitize routes through in-cabin technology and garbage level sensors

The third opportunity to deploy technology is by fully digitizing collection routes, with sensor technology in containers and on-truck routing tech. This combination would increase collection efficiency and decrease truck miles traveled. It costs DSNY significantly more to collect trash than to dispose of it,<sup>53</sup> so fully digitizing routes and collection schedules would be in the City's best economic interest as well. Digitized routing and sensor technology will be required to get the maximum benefit from containerization.

The way that DSNY operates today, even though turn-by-turn routing technology is available on most of the department's trucks, it is used only for snow removal and not for garbage collection services. That's because the truck's operators have access to changing

## Transforming NYC's waste collection with technology

“Containerization of waste with sensor-enabled dynamic routing for collection through semi-automated trucks will improve collection efficiency, citywide street cleanliness, and worker safety.”



snow-accumulation data, but they don't have dynamic data about where the trash is—which is where containerization (beyond the humble trash pail) comes in.

For dynamic routing to live up to its promise and for truck miles to be optimized, the City requires dynamic data from smart sensors in containers at large pickup locations such as apartment buildings. Such sensors are equipped with ultrasound technology that can measure and monitor fill levels and send this data to a cloud-based platform.<sup>54</sup> This data on container fill levels can then be used to provide drivers with real-time information on which containers are ready to be serviced.

The technology exists, and it has already been successfully tested in a number of cities.<sup>55</sup> In 2019, San Francisco installed garbage-level sensors along major commercial corridors;<sup>56</sup> Since then, the city has seen an 80 percent drop in the number of overflowing bins, a 64 percent decrease in illegal dumping, and a 66 percent decrease in need for street cleaning.<sup>57</sup> Seoul, with a population of more than 9.9 million people, has deployed smart waste management solutions incorporating sensor technology, resulting in cleaner streets as well as operational cost efficiencies.<sup>58</sup> More recently, Miami has implemented cameras and sensor technology in dumpsters to monitor how full the dumpsters are, when they are being serviced, and what types of waste go in them.<sup>59</sup> This smart camera technology helps the city of Miami adjust collection

schedules to meet the actual waste output instead of servicing half-full dumpsters multiple times a week, and has the potential to decrease collection costs between 30 percent and 40 percent while also helping the city learn from people's waste disposal behaviors.

In 2019 Kansas City, Missouri, began using technology provided by a company called Rubicon to improve collection efficiencies and cut costs. The city equipped every driver in the department's operating fleet of trucks with a smartphone or tablet running software that showed them all of their dynamically changing stops in order, like a digital route sheet. Additionally, this technology empowers drivers with data by enabling them to document issues at the curb, like trash not being set out for collection in time or collection being blocked by a parked car or other object. The streamlined data gets sent back to a centralized manager portal to enable quick decision-making to adapt to the city's needs and dynamically changing conditions in real time. As a result of this digitized system of dynamic routing and trash collection, Kansas City has seen a reduction of \$2 million in costs and a 17 percent increase in resident satisfaction with sanitation services.<sup>60</sup>

It is worth noting that adopting this technology will not cut jobs. Dynamic routing will improve collection efficiencies at the aggregate city level and will allow for speedier and more frequent pickups by ensuring that collection takes place at the right time. This means maintaining the same employment level to allow for those additional collection services while also cutting the inefficiencies associated with each individual collection route. In addition to sensors, New York City should integrate in-cabin technology for route optimization (compatible with sensors) to not only decrease collection inefficiencies and truck miles traveled for a given route, but also improve worker satisfaction by empowering the truck drivers with this technology.

While collection efficiency from route optimization is the most important and beneficial use of this technology, DSNY can also use data from container sensors as an educational tool to learn about waste patterns and implement longer-term policy changes and collection/service efficiencies.<sup>61</sup>

These technologies together can help upgrade the City's system of waste management from generation to collection. This starts with handling organic waste on-site through AD to divert the flow of organic waste away from landfill; continues with storing waste that cannot be handled on-site in sensor-enabled containers; and culminates in semi-automating collection trucks to hoist these containers and enabling drivers to follow dynamically changing routes to optimize collection efficiency.

## An agenda for the new administration

Implementing new technology systems will require a commitment on the part of DSNY to shift to new patterns of operations and fleet management over time. As a result, none of these systems offers a fast implementation path. However, the longer New York City delays adopting these technologies, the longer it will take for eventual deployment.

### 1 Establish a long-term goal for the City for on-site anaerobic digestion

The first step in embracing on-site AD would be for the City to explicitly prioritize the handling of organic waste on-site. While not every single building in New York City will ever have this technology, an overall goal, such as this, is vital to set expectations and shape DSNY and other City agency policies. As a matter of deployment, on-site anaerobic digestion can be piloted in restaurants, commercial buildings, institutions, and, ultimately, multifamily buildings. AD also contributes positively to the City's ultimate shift away from natural gas, because it would allow buildings to produce small volumes of on-site, renewable biogas that could be used for limited purposes, such as heating water for domestic consumption.

This long-term goal-setting process the City must begin with the following action items:



1. Undertake a survey and catalog of all AD technology that is either in operation within the city or in the market to understand its suitability for New York City and develop a clear understanding of requirements.
  2. Kick off an interagency task force charged with understanding the code implications of onsite AD. This group will be tasked with making a set of recommendations for the proposed changes to the code to the Mayor and City Council by February 2023. The agencies will include DOB (for energy and construction/building code), FDNY, DEP, and HPD (for NYC Housing Maintenance Code<sup>62</sup>) at a minimum.
  3. Initiate a joint advisory board managed by the Mayor's Office of Sustainability, working with the restaurant industry to understand the potential financial implications of on-site anaerobic digestion and explore ways to either make these installations self-financing (they will generate savings for businesses from reduction in collection costs paid to private haulers) or provide public support/make financing arrangements to enable small restaurants and businesses to invest in on-site anaerobic digesters.
  4. Work with the Department of Education and the School Construction Authority to explore the potential for AD in schools.
  5. Consider subsidies for early adopters. An anaerobic digester that is used regularly will significantly reduce waste hauled by DSNY (if residential) or private carters (if commercial).
1. Tradeoffs between potential need to maintain a dedicated fleet of plows versus reduced injuries and speedier pickups from auto-loaders.
  2. Economic and health benefits from containerization of waste, including mitigation of vermin, cost savings, and improvement of sidewalks.
  3. Fears that containerization and automation of trucks is a labor saving approach. The potential improvements in citywide cleanliness and health that could derive from more frequent pickups can only be made possible by maintaining a fixed employment level and increasing the frequency and speed of pickups. We can continue using the same fleet for the next five years, but during this time it is critical that we do the groundwork for automation of trucks so that ultimately we can prioritize the health and safety of sanitation workers.
  4. Operational feasibility for more frequent pickups with smaller trucks.

In addition to the study, we recommend that the City creates an opportunity for New Yorkers to see state-of-the-art tech for trash containers and trucks through a coordinated demonstration effort that would start with an RFEI and make waste solutions and waste technology more visible in the public space.

We also propose that the City invest in providing better incentives for participation in containerization efforts such as the Clean Curbs program. Currently, the RFP for the Clean Curbs program does not adequately incentivize organizations to participate. BIDs, organizations, and commercial establishments either do not have enough motivation or sufficient resources to take part.

To overcome this issue, we recommend that the City group various BIDs and organizations together into a task force, and incentivize them to work together with designers and architects who can put together a prototype that works for New York City as a whole. Then the City should help with the implementation of the plan. Even larger BIDs and organizations that want to containerize waste in their neighborhoods may not have the resources to conduct expensive research and to prototype containers. It is likely that only the biggest BIDs in the city have enough capacity for this type of

## 2 Develop a plan for citywide containerization of waste and semi-automated collection

We recommend that the City immediately enact and commission a DSNY study to evaluate the benefits of moving toward an automated collection and containerized waste program, including evaluations on the following issues:

investment. This results in an equity problem, which we recommend be minimized by pairing them with BIDs in other lower income areas.

Finally, we recommend that the City expand the new rule that requires the submission of a waste management plan<sup>63</sup> for new or newly renovated buildings with more than 150 units to also require containerization of waste and include design considerations to allow for use of containers, including curb cuts and loading areas for trucks to stop for collection.

### **3** **Initiate the process to integrate sensors in containers to enable dynamic routing**

The City should commission a study to start the process of integrating technology for dynamic and fully digitized routing into DSNY trucks. The City should issue an RFI to the waste technology industry to gather ideas on what solutions exist in the market, and to better understand how they might be applied to the opportunity of dynamic routing for DSNY. This initiative must include identifying a set of routes with highly variable volumes where dynamic routing might make sense and where it might be an appropriate location for piloting. The findings of this study should be geared to then accommodate on-board GPS and dynamic routing in the next DSNY labor contract negotiation, if it is not currently included.

### **4** **Fully explore technology as part of the planning for the new Solid Waste Management Plan**

New York City's solid waste management is governed by a Solid Waste Management Plan (SWMP), a strategy required by law and adopted in 2006. The current SWMP had a 20-year duration and will expire in 2025, which means that the incoming administration will need to develop a new SWMP. As a precursor to that work, DSNY and the Mayor's office should commission a creative exploration of a wide variety of waste management technologies that could be brought to

bear on the City's long-term waste system and the achievement of its established goal of zero waste. For example, new recycling technologies allow plastics to be separated down to the molecular level, which results in a much purer stream that is highly valuable to manufacturers.<sup>64</sup>

## **Privacy and equity concerns**

We have not identified any privacy concerns with the proposed solutions.

As for the equity implications, while there is evidence that small-scale anaerobic digestion could be self-financing, the need for capital investment could have potential negative impact on small businesses, particularly in lower-income neighborhoods, where businesses often find it more difficult to access capital. The City should consider the creation of a finance facility to encourage the equitable adoption of on-site AD.

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## 3.7 Accelerate renewable energy adoption in the City by promoting battery energy storage

Reducing carbon emissions from buildings by fully electrifying systems in homes and offices is a primary means for New York City to reach its climate goals. But demand peaks at times that do not coincide with the hours that renewable power is at peak generation, so a clean grid will require energy storage. New York City lacks the space for large-scale, outdoor storage, but battery storage in individual buildings, with proper safety measures, will help to facilitate the widespread adoption of clean electricity.

consists of ramp-ups and ramp-downs that are gradual. But renewable technologies—most notably solar power—do not produce their maximum yields when demand is highest. As more of the grid is served by solar power, the mismatch between the daylight hours, when power is generated, and the demand after dark becomes a critical challenge. Energy experts call this phenomenon the “duck curve,” because the resulting load drawn from the grid resembles the silhouette of a duck.<sup>2</sup>

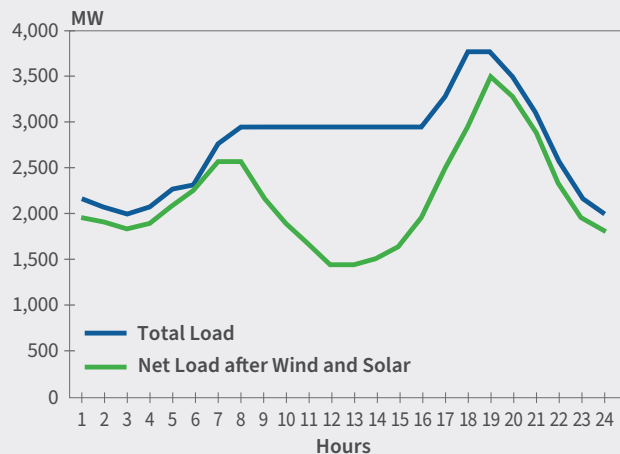
### The problem we face

Climate change is a key challenge facing New York City, and shifting quickly away from fossil fuels for powering and heating our buildings is a crucial component of our response. The existing City and State climate initiatives are aggressive: 6,000 megawatts (MW) of solar energy statewide by 2025; 100% carbon-free electricity statewide by 2040; an 80% reduction in building emissions in the City by 2050.<sup>1</sup> These initiatives will require increased electrification in the City’s buildings. Gas heat and cooking, for instance, will be replaced with electric solutions to reduce emissions. Increased electrification, paired with increased generation of electricity from renewable sources, will fundamentally change the profile of power operations in New York City.

In the current system, demand for electricity follows a well-known pattern: a small peak in the morning is followed by steady usage throughout the day; then there is a second peak in the evening as people get home from work. This pattern is easily predictable, and

### The duck curve

Increased usage of renewables leads to a ramp-up in demand at the end of day, just when the sun goes down. Storing excess energy generated during daylight hours can help meet the end-of-day ramp-up.



Data source: The Regulatory Assistance Project.

The Ravenswood Generating Station, in Astoria, Queens, is a “peaker plant,” whose emissions contribute to the neighborhood’s nickname of “Asthma Alley.” Replacing energy generated by peaker plants with batteries would have public health benefits.



Photo credit: Ben Oldenburg.

Miami’s Manatee Energy Storage Center sprawls over the equivalent of 30 football fields. Such utility-scale battery projects require too much open space to be practical for denser urban areas such as New York City.



Photo credit: Aaron DeMayo, Future Vision Studios.

The solution to the duck curve mismatch is energy storage. Energy storage systems allow both utilities and end users to store energy that is generated at one time of day for use at a later time.<sup>3</sup> These systems reduce costs for utilities and consumers, increase the efficiency of the grid, and improve grid resilience, all of which makes it easier to integrate clean energy into the grid.<sup>4</sup> Finally, energy storage can replace fossil fuel power plants in the City. Known as “peaker plants,” these generators were built to meet periods of high demand, but come at the cost of disproportionately worsening the surrounding air quality. The rate of asthma-related emergency room visits in neighborhoods near peaker plants is triple the average rate in the City.<sup>5</sup> Nearly 78% of the 750,000 New Yorkers that live within a mile of a peaker plant are lower-income or people of color.<sup>6</sup>

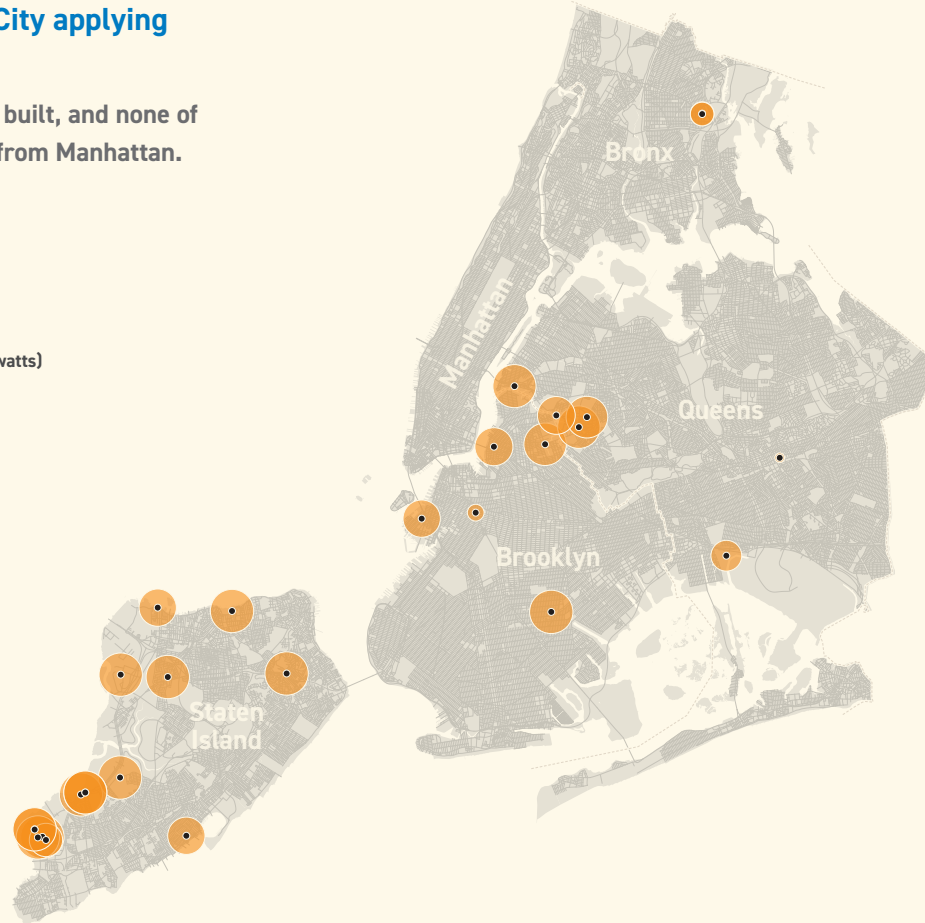
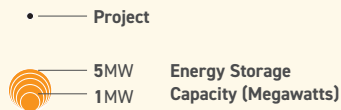
The State’s Climate Leadership and Community Protection Act, recognizing the multitude of benefits that a robust energy-storage network could provide, set a statewide storage goal of 3,000 MW of capacity by 2030, building on a previous target of 1,500 MW of capacity by 2025.<sup>7</sup> For scale, the State’s Public Service Commission (PSC) estimates that 1,500 MW of storage capacity is equal to the electric demand of one-fifth of all homes in the State.<sup>8</sup> Similarly, the City is targeting 500 MW of energy storage capacity by 2025, enough to power anywhere from 400,000 to 500,000 homes.<sup>9</sup> A report from the Mayor’s Office of Climate and Sustainability (MOCS) found that this goal will need to increase to anywhere from 6,000-10,000 MW of energy storage capacity by 2050 to meet the City’s goal of reducing emissions by 80%.<sup>10</sup>

Energy storage can come in many forms, but batteries are currently the most cost-effective and scalable solution to flatten the duck curve created by the intermittency of wind and solar.<sup>11</sup> We already have some batteries being used for energy storage and cost savings in residential and commercial buildings around the City, but they utilize older battery technologies. These batteries are also relatively small, on the order of around 100 kilowatts (denoted “kW,” 1 MW = 1000 kW) per project.<sup>12</sup> Newer battery technologies have a higher energy density, meaning that they can provide a higher amount of power per unit volume. However, these newer batteries can still require a large amount of space to meet existing storage goals, and their deployment is limited by fire safety regulations.

## Battery projects in the City applying for NYSERDA funding

None of these have yet been built, and none of the project applications are from Manhattan.

Data source: NYSERDA.



Utility-scale storage projects are typically on the order of hundreds of megawatts, if not thousands or tens of thousands. One such facility is the Florida Power and Light Manatee Energy Storage Center in Miami, a complex that occupies 400 acres of land (about 30 football fields), to deliver 409 MW of power—equivalent to less than 4% of New York City’s peak electricity demand in 2019.<sup>13</sup> New York City, however, has almost no available space on this scale. The City does have one notable project of this type: the 100 MW East River Energy Storage System.<sup>14</sup> The batteries for the project require a footprint of about 131,000 square feet and will be built out on a parcel of land that is almost 4.5 acres.<sup>15</sup> Similarly, the 5 MW Nevins Charging Hub in Brooklyn will be large enough to provide power to more than 5,000 apartments for four hours during summer peak demands, but requires an entire city block of space.<sup>16</sup> While there are likely a few additional locations where this kind of project can and should be developed in the five boroughs, they are unlikely to meet the city’s needs for energy storage.

To promote the growth of energy storage, the New York State Energy Research and Development Authority (NYSERDA) offers financial incentives for new projects and tracks the number of storage projects in the State.<sup>17</sup> But battery storage adoption in the City proper has been slow. Since 1990, some 1,100 battery storage projects have been completed in New York State, but only 32 of those are located in the City.<sup>18</sup> Only about 30% of projects currently applying for NYSERDA incentives are located in the City, and no project applications are being submitted from Manhattan.<sup>19</sup> Additionally, a year after the Mayor announced a goal of 100 MWh for projects that pair solar with energy storage in the City by 2020, only 4.8 MWh of storage had been installed.<sup>20</sup> The easiest and most obvious approaches to battery storage are clearly less well-suited to New York City than to the rest of the state.

The challenges associated with battery storage are particularly problematic at a time when New York City is in need of major changes to its building stock, all of



**Distributed energy storage, like the Tesla Powerwall, can provide energy cost savings and emergency power to buildings.**

Photo credit: SunCommon.

which would benefit from battery storage. At press time, the City Council approved a law that effectively bans natural gas as a fuel for new construction in New York City.<sup>21</sup> The Climate Mobilization Act of 2019, known as Local Law 97 (LL97) will require the decarbonization of large buildings across the city, and many of these are expected to have to fully electrify in order to meet the law's targets by 2030.<sup>22</sup> Various other initiatives are also working to bring electrification and on-site solar panels to the City's smaller buildings; these include BlocPower, a for-profit startup that has received significant funding, and Public Solar, a proposal by incoming Comptroller Brad Lander to create a nonprofit entity to develop solar power on rooftops across the city, most of which belong to single-family homes.<sup>23</sup>

## The technology opportunity

Although the five boroughs of New York City likely don't have the space for centralized, large-scale energy storage at the scale the City needs, the technology does exist to enable individual buildings to take advantage of energy storage. Smaller-scale distributed energy storage can provide cost savings to buildings and be a source of emergency power in the event of a grid outage.<sup>24</sup> Just as utility-scale batteries can help make better use of utility-scale solar energy, distributed batteries can help building owners better utilize their own rooftop

**“The challenges associated with battery storage are particularly problematic at a time when New York City is in need of major changes to its building stock, all of which would benefit from battery storage.”**

solar.<sup>25</sup> Unlike solar, distributed batteries can be flexibly deployed to meet different criteria. Batteries can be placed on rooftops, in parking lots or garages, in unused spaces, or elsewhere to meet differing design criteria.

The greatest challenge with deploying the most efficient and economically viable distributed batteries has been meeting fire safety requirements. Up until December of 2021, the fire code only allowed for these technologies to be installed outdoors in the City, severely limiting the available space for projects. Real estate companies with portfolios that include New York City have opted for battery projects outside of the City because of these limitations. In early 2021, real estate company AvalonBay installed a first-of-its-kind indoor battery project in the State, but the installation was at one of their buildings in White Plains, rather than in one of their buildings in the City.<sup>26</sup>

Lithium-ion (or Li-ion) is the predominant battery technology available today. Compared to other types of batteries, Li-ion batteries store lots of energy in a small space, last longer, and waste less of the power they store. They also have short ramp-up times, meaning they can quickly reach their maximum power output.<sup>27</sup> Other battery chemistries have been used in the past to provide emergency backup power to buildings, but to date, only Li-ion batteries can provide the energy density and power capacity at the prices necessary to provide emergency backup power and sell power into the grid—thereby providing another source of revenue for building owners and strengthening the City's energy resilience by distributing and diversifying energy generation. Li-ion batteries are also one of the most cost-effective battery technologies available,



having declined in price 70% between 2010 and 2016, with projections for further decline in the future.<sup>28</sup> The price drop in Li-ion batteries parallels the price drops previously seen in wind and solar power, a key indicator for predicting future growth and demand for the technology.<sup>29</sup>

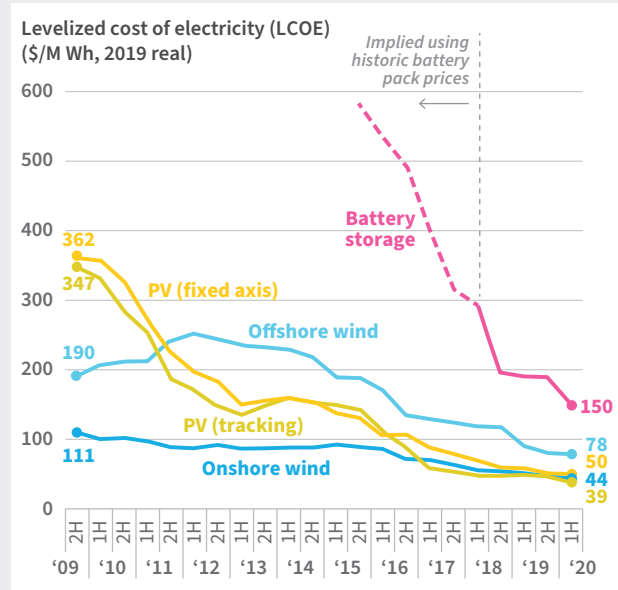
Another reason battery storage is getting more attractive is that systems are increasingly available in standardized packages, which simplifies the connection of the system and the evaluation and certification processes.<sup>30</sup> However, this packaging usually comes in the form of a standard shipping container, which is not likely to fit simply into most New York City buildings. Standardized shapes and sizes for indoor, smaller-scale battery installations appropriate to New York's buildings would be a useful innovation.

Distributed battery storage is attractive for building owners because of the cost savings and added revenue streams it enables. Batteries can be used to manage the amount of electricity the building consumes from the grid based on price. Commercial buildings pay for electricity based on the time of day: at peak hours, the price is higher, while at off-peak hours, it goes down. As a result, buildings with storage can arbitrage this difference, saving up low-cost overnight power from the grid, or excess power from their onsite solar panels, and using that power during the evening peak when grid prices are highest.<sup>31</sup> Utilities also will pay customers to cut back their grid energy consumption during those peak periods. Called "demand response programs," these incentives reduce both the likelihood of blackouts and the need for grid upgrades.<sup>32</sup> If battery projects were developed in Manhattan, some estimates predict battery owners could make \$20,000 in added annual revenue through ConEd's demand response programs.<sup>33</sup>

As a result of these factors, New York City could see a dramatic increase in battery storage over the next few years. Projections from the Solar Energy Industries Association predict the number of distributed solar projects that are combined with a battery will increase fivefold from 2019 to 2025.<sup>34</sup> Some of this growth will be motivated by regulations like the City's LL97, which was enacted in 2019 to regulate carbon emissions from buildings by charging buildings that exceed emissions thresholds.<sup>35</sup> A study by the Urban Green Council

## Declining costs of renewable energy

The declining costs of battery storage today mirror the declining costs of wind and solar power a decade ago, signaling a future uptick in adoption of this technology.

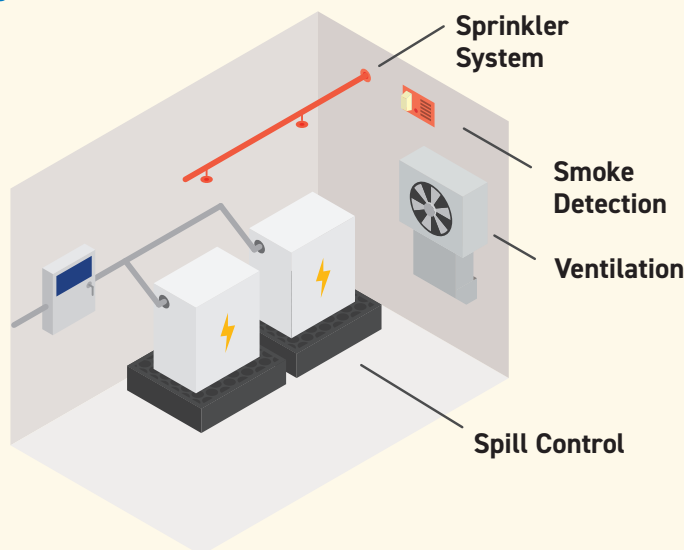


Data source: BloombergNEF. Note: The global benchmark is a country weighted-average using the latest annual capacity additions. The storage LCOE is reflective of utility-scale projects with four-hour duration; it includes charging costs.

“Distributed battery storage is attractive for building owners because of the cost savings and added revenue streams it enables.”

## Fire code requirements for battery storage

The new fire code allows for indoor Li-ion batteries of up to 400 kWh per control room. These batteries must be protected by features such as sprinkler systems, ventilation, smoke detection, and spill control for any leaks.



found that LL97 will apply to approximately 50,000 of the City's buildings, or approximately 60% of the City's building area.<sup>36</sup> Building owners could face fines as high as \$5 million if they emit too much carbon,<sup>37</sup> projects such as solar and battery installations could greatly help mitigate carbon emissions and reduce or completely eliminate fines.

### Battery safety

A major limitation for battery storage in New York City is how batteries are regulated by the fire code. Deploying any energy-dense technology in an urban environment raises some measure of safety concerns, and Li-ion battery energy storage is no different. The New York City Fire Code, overseen and enforced by the New York City Fire Department (FDNY) regulates whether, and under what conditions, indoor battery storage can take place in New York.

The main threat with batteries is that they will experience thermal runaway, a state in which the battery uncontrollably overheats, which can lead to fire or even an explosion.<sup>38</sup> There have been high-profile failures of utility-scale Li-ion storage, and these failures can cause physical damage, inflict personal harm, and negatively impact future developments. All this slows the overall transition to a cleaner power grid and presents a public safety risk, which is why fire safety is critical for these systems. Thankfully, a consensus has

emerged amongst industry leaders, standards groups, academics, and fire safety regulators and community advocates that fire safety needs to be a part of the design process from the beginning, rather than an afterthought.<sup>39</sup>

The risks associated with battery storage have led FDNY to move cautiously in allowing such systems in New York. In 2019, FDNY adopted Rule 3 RCNY 608-01, which regulates outdoor energy storage systems. Being outdoors, these create fewer risks to safety than projects where a battery would be inside a building.<sup>40</sup> But outdoor space is at a premium in New York City: while some projects are moving forward using outdoor space on the roofs of tall buildings, there is heavy competition for such space from solar panels, outdoor tenant space, and HVAC and mechanical modules. Further, the rule did not allow for indoor batteries, which limited battery projects in the City and prevented building owners who had older types of batteries in their buildings from switching these out for newer, Li-ion batteries.

To address the growing desire and need for indoor battery installations, the City Council recently adopted an updated fire code that amended section FC 608, titled "Stationary Energy Storage Systems," to allow for up to 400 kWh of indoor Li-ion battery installations per control area.<sup>41</sup> Each of these 400 kWh installations

**New York City can be a leader in the energy transition by creating urban standards for battery storage.**

Photo credit: Jonas Brief.



could provide enough power to satisfy peak power demand of 100 apartments for four hours at a time—enough to get through the post-sunset peak period, when the grid is most strained.

The new code requires careful design to ensure that the risk of thermal runaway does not lead to a catastrophic fire. Under the new rules, indoor installations in the City would need to satisfy a number of safety requirements, including full sprinkler protection throughout the building, dedicated smoke detection and ventilation systems for the room where the battery is stored, and proper spill containment for any liquids that may leak from the battery. While these will impose costs, our interviews suggested that these requirements are not likely to prevent the uptake of battery storage, especially in large multifamily apartment buildings.

Importantly, the new fire code relies on rigorous testing developed by industry standards groups that will verify the fire safety of individual battery systems.<sup>42</sup> The new fire code also has exceptions carved out for single family homes and duplexes, which will mitigate the potential for safety features being too impractical for these types of buildings. This is all good news because, while battery fires have been in the news recently, there is no reason to believe that these home-storage systems are unsafe. Rigorous testing of Tesla's stationary storage batteries with the National Fire Protection

Association found them to be safe.<sup>43</sup> Here in New York, there have been a series of fires related to the batteries of electric bikes, but those fires are most likely due to poor-quality batteries sold directly to consumers.<sup>44</sup> Because battery storage systems will require licensed professionals to install, even at the single-family-home level, the kinds of fires resulting from e-bike batteries are not a risk. The new fire code upholds fire safety and creates an environment where indoor battery installations can proliferate, all of which will influence increased adoption of this technology.

## An agenda for the next administration

It is in New York City's best interest to promote quick and widespread adoption of distributed energy storage while maintaining high safety standards. Our research indicates that the incoming Administration can support these goals, and the City's overall need to transition to a clean energy future, by undertaking the following near-term efforts:

## 1 Develop a streamlined permitting and approval process for storage

Deploying an energy storage project in the City is a multistep process that requires multiple approvals and assessments. Li-ion battery projects require sign-offs from FDNY, the Department of Buildings (DOB), NYSERDA, and ConEd, to name a few.

Similarly complicated processes were required for solar energy in the City when that was still a nascent technology. With the help of City institutions like Sustainable CUNY, the City was able to simplify the process for solar installations, which led to continued doubling in solar deployment targets.

To duplicate this success, the City should work to develop a similar simplified process for energy storage proposals, which would improve the speed and economics of such projects. A report from the State's PSC estimates that streamlining the approval process would reduce the soft costs for battery projects, which currently can account for up to 20% of the total cost, by anywhere from 50% to 75%.<sup>45</sup> Citing this report, the Mayor's Office of Climate and Sustainability (MOCS) concluded that this cost reduction could be achieved while upholding safety standards.<sup>46</sup>

To do this, the City should convene a task force involving MOCS, FDNY, and DOB. All three of these entities are instrumental in the development and approval of battery projects in the City. The City should also include institutions like Sustainable CUNY, which in 2020 published an energy-storage permitting guide in collaboration with FDNY, DOB, and ConEd.<sup>47</sup> This guide only covers permitting processes for outdoor installations; with the new fire code allowing for indoor installations, the City should support development of a similar guide.

## 2 Undertake an aggressive effort to encourage battery storage projects where they are needed most

While any battery storage will help improve the overall energy economics and carbon emissions in the City, these projects will be most well suited to certain building types and in certain areas. They will be especially useful in instances where the existing energy grid carries the heaviest load, and is thus most at risk of failure during a peak consumption event. Significantly, many of these so-called "load-pocket" areas are in low-income or environmental justice neighborhoods, which means that targeted battery deployment would not only help the environment in general but would also contribute to environmental justice by reducing the likelihood of blackouts in those neighborhoods.<sup>48</sup> Further, while some building owners and managers may know about the potential for battery storage, most are likely unaware—even if their building's characteristics, size, and location would make it a prime candidate for a profitable battery installation.

To get batteries installed where they are needed most, and to encourage the broadest possible adoption, the City should task the NYC Accelerator—an entity established by the City to provide information to building owners and managers about energy-saving opportunities—with identifying where the most appropriate buildings are, and especially those in load pockets and where reductions in peak demand would lead directly to lower utilization of polluting peaker plants. The Accelerator should then actively recruit such buildings. Such an effort would likely best be done in cooperation with NYSERDA, ConEd, and area universities.

## 3 Fully integrate battery storage into the City-led building decarbonization programs and policies

Like rooftop solar and energy efficiency efforts, battery storage is benefitting from declining costs, federal and state incentives, and long-term energy trends. However, all three interventions require planning and capital

investment on the part of building owners. Further, battery storage is a newer concept than solar and efficiency, and therefore requires greater attention. In addition, because many of the City's current rules and practices were written before small-scale battery storage was fully available, these need to be updated. As a result, the City, most likely through MOCS, needs to ensure that battery storage is fully integrated into all building decarbonization efforts.

One program already does so. The City's Property Assessed Clean Energy (PACE) program provides financing solutions for energy efficiency projects, including battery installations.<sup>49</sup> PACE is a young program, but does show promise and is garnering interest in the real estate community.<sup>50</sup> Because the first PACE loan was only awarded in early 2021, the City should continue to monitor the success of the program and adjust or expand it as necessary.<sup>51</sup> Further, it should ensure that eligibility of battery storage projects is fully highlighted in PACE-related communications.

The City has also begun to focus on one- to four-family homes as a crucial target market for energy efficiency and solar. The Electrify NYC program provides technical assistance for homeowners interested in installing heat pumps and solar panels. It should expand this program to cover battery storage, along with EV chargers for homes equipped with a garage.<sup>52</sup> If a project such as Public Solar does get enacted, it, too, should incorporate battery storage as part of its offering, not just rooftop solar.

Finally, the City has a variety of laws focused on decarbonizing buildings, but these do not fully incorporate the potential of battery storage to contribute to decarbonization. LL 97, for example, does not account for the fact that the time-shifting enabled by batteries can reduce the carbon footprint of the building's electricity consumption, because energy stored overnight or in the morning will have a lower carbon intensity than energy consumed from the grid in the evening peak. It seems likely that DOB has the ability to account for this in rulemaking, and it should do so.

## Privacy and equity concerns

We have identified no privacy issues with this set of recommendations; battery storage systems present no unusual means for government or private actors to obtain information about New Yorkers.

With respect to equity, these recommendations present an opportunity to address historic inequities in energy availability and reliability in the City. Additionally, public health issues caused by fossil fuel-powered generators in the City can be alleviated through these recommendations. All of these historic issues have disproportionately impacted low-income and majority Black and brown neighborhoods in the City; this presents an opportunity to address past environmental racism. It is also important that the City influences the energy transition in a manner that it does not benefit only the affluent. Similar concerns were raised when solar power was first making headway in the United States, with advocates concerned that only those with more assets would have the means to invest in solar power, thus saving money on their electric bill and perpetuating economic inequality.<sup>53</sup> Projects such as ElectrifyNYC and the proposed Public Solar would address this concern if they fully integrated battery storage, as recommended above.

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## **4** Always open: Make it easier to engage with the City

The importance of City government to our daily lives means that New Yorkers interact with the City on a regular basis: to register our children for school, to pay our taxes, to renovate a home, or to speak out on a neighborhood issue. One of the tremendous benefits of 21st-century technology has been the way it makes interactions easier, both by using computers and phones as gateways to people and information, and by eliminating some of the frictions of time and space.

We have found that there are many ways in which the City could use technology to make it easier for New Yorkers to communicate with the City to get things done. These opportunities include making it possible for New Yorkers to ask one City agency to share personal data with another agency and keeping Community Board meetings hybrid or virtual to expand participation. Technology also offers new ways for the City to be held accountable for its performance and to broaden the way democracy is practiced. Taken together, these could lead to a more responsive and more equitable city.



## 4.1 Make it easier for New Yorkers to obtain social services through the creation of a digital data locker and interagency verifications

Millions of New Yorkers need social services from the City, ranging from direct financial assistance for older adults to public education for children. These interactions between the public and City agencies should theoretically be seamless. In reality, however, each agency has their own way of keeping track of an individual's information, who they are, and what they are eligible for, making these interactions time-consuming and difficult—especially for the New Yorkers most in need. The irony is that much of the information required to verify eligibility already exists within the City government. The next Mayor should create a “data locker” system through which New Yorkers can gather their information and share it in a standardized way with multiple agencies, and establish a universal approach to applying for services across all City programs.

### The problem we face

Millions of New Yorkers qualify for public benefits designed to help families and individuals who are experiencing hardship to maintain economic security. Supplemental Nutrition Assistance Program (SNAP), the most widely used benefit administered by New York City Human Resources Administration (HRA), supported one in five City residents in January 2021.<sup>1</sup> In addition to SNAP, New Yorkers qualify for and/or receive dozens of other benefits, including housing adjustments, direct cash transfers, childcare—or even public education for their children, which we generally don't consider “public assistance” but which is, essentially, a qualified benefit.<sup>2</sup>

Finding and applying for these benefits has long been a challenge for New Yorkers, especially those in the greatest need. Many different agencies administer benefits programs, often targeted at the same individuals. For example, a low-income single parent with a toddler might receive SNAP from HRA for food expenses, a Section 8 voucher from the New York City Housing Authority (NYCHA) for rent support, enroll their toddler in Early Head Start through the Department of Education (DOE), and seek filing support from the Department of Finance (DOF) to complete their Earned Income Tax Credit (EITC).

The de Blasio administration has made significant progress in using technology to ease the process of finding and applying for these benefits. In 2017, NYC Opportunity relaunched ACCESS NYC, updating a website first created in 2006 under Mayor Michael R. Bloomberg and making it mobile-friendly, a crucial development for the many lower-income New Yorkers who primarily use the internet through their phones. ACCESS NYC now allows New Yorkers to input economic and demographic characteristics and receive a list of potentially applicable benefits programs from a wide cross-section of City agencies, as well as several state and federal agencies. At the same time, HRA created ACCESS HRA, a mobile-friendly website and app where New Yorkers can apply for SNAP, Cash Assistance (CA),<sup>3</sup> One Shot Deal, Medicaid renewals, and Fair Fares programs; recertify their program eligibility; and manage their applications. HRA also created a mobile app to enable users to manage their case and upload documents.<sup>4</sup>

“In 2019, roughly half of the applications submitted for food and cash assistance were rejected, according to a 2020 audit; the largest single cause of these rejections was related to incomplete documentation.”

These new application avenues demonstrated their value immediately. Even before the pandemic, only two years after it launched, nearly 90% of SNAP applicants took advantage of ACCESS HRA's online application, a proportion that has continued to increase.<sup>5</sup> Applications for CA only became available in a digital format in March 2020; since then online applications have accounted for 85% of the total. The switch to online applications has also been crucial for the agencies' ability to handle the increased demand for assistance caused by the pandemic, which drove application rates up by more than 50% for CA and 100% for SNAP during the second quarter of 2020.<sup>6</sup>

Despite these successes, it's still too difficult to navigate the City's benefits systems.

First, the documentation that proves eligibility for a given benefit is difficult to compile. Each program requires a set of documents, often including identity, marital status, relationship status, residence, household composition/size, age, resources, Social Security number, immigration status, earned and unearned income, medical expenses, utility expenses, health insurance, and dependent care costs.<sup>7,8</sup> While there are reasons for most of these requirements, they add up to a significant burden. In 2019, roughly half of the applications submitted for SNAP and CA were rejected, according to a 2020 audit completed by HRA; the largest single cause of SNAP rejections was related to incomplete documentation.<sup>9,10</sup> Advocates also report that applicant documentation is often lost after submission. The Urban Justice Center reported that 25% of SNAP and 50% of CA applicants interviewed said that caseworkers had lost their paperwork.<sup>11</sup> The resulting

high number of rejected cases not only delays benefits for qualified applicants who may need to reapply, but also creates an extra burden for caseworkers.

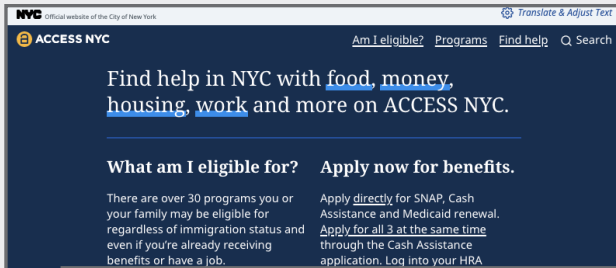
Second, while ACCESS NYC helps applicants identify what benefits they might be eligible for, it then directs them to separate agency websites that all look and feel entirely different. Each agency has different documentation requirements and application processes—and even when the requirements are similar, radically different user interfaces can easily lead an applicant into confusion. Clients are required to navigate to different platforms, learn new interfaces, and reenter their information to apply for and manage the benefits to which they are entitled. This creates a huge burden of repetition. One report concludes that to apply for a basic set of benefits—SNAP, CA, Section 8, WIC (the supplemental nutrition program for women, infants, and children), and EITC—required 12 pieces of documentation, 5 of which needed to be submitted at least seven times.<sup>12</sup>

## The technology opportunity

These problems of eligibility documentation and benefits navigation for cross-enrollment are highly susceptible to technology solutions commonly used today. While any aggregation of personal information must weigh the security risks, we have come to rely on digital document storage, data sharing, and the accompanying consent frameworks in many industries, including finance and healthcare. These solutions reduce the burden of data entry and document submission on clients, increase the speed of transactions, and allow service providers a more holistic view of the clients' situation.

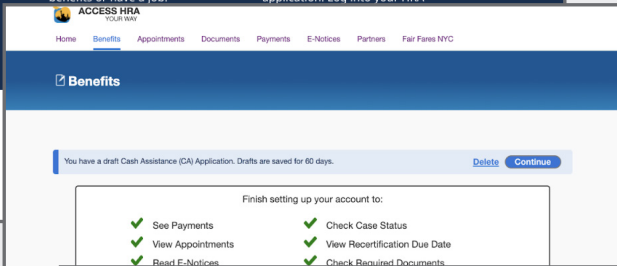
The irony of the documentation burden is that in most cases, government agencies are asking for records created and held by other government agencies. For the nearly half of all New Yorkers born in New York, the Department of Health and Mental Hygiene has their birth certificate; for a public school student, the DOE has all of their vital records, including where they live, who their parents are, and whether they have received their vaccines.<sup>13</sup> If they were married in New York, the City Clerk has their marriage certificate. For any of these, the originals are effectively stored

## NYC agency benefits applications and portals share few, if any, common elements, requiring users to navigate vastly different experiences



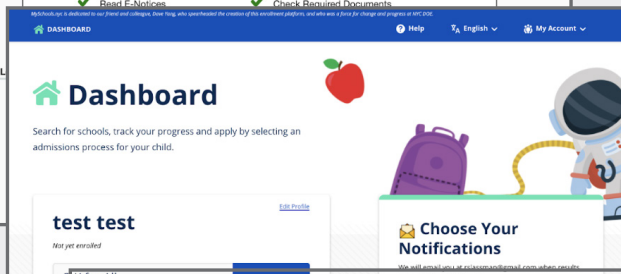
### ACCESS NYC

Agency: The Mayor's Office for Economic Opportunity  
Program: Eligibility screener



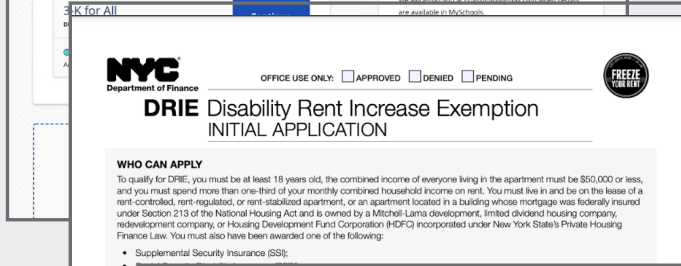
### ACCESS HRA

Agency: New York City Human Resources Administration  
Program: SNAP, CA, Medicaid, One Shot Deal, Fair Fares



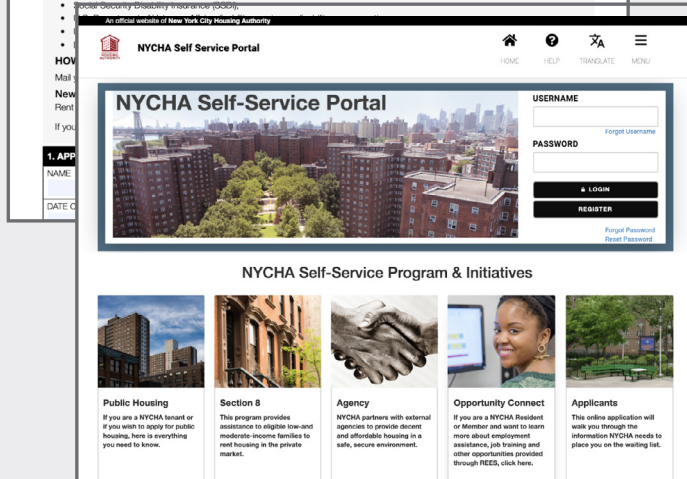
### My Schools

Agency: New York City Department of Education  
Program: EarlyLearn



### PDF Application

Agency: New York City Department of Finance  
Program: DRIE



### NYCHA Self Service Portal

Agency: New York City Housing Authority  
Program: Section 8

“The ability to have a record sent upon request from one City agency to another is a challenge that technology can easily help solve. No additional fees or documentation requests should be necessary.”

in the computers of City agencies—so the burden of documentation essentially means that one agency is asking a New Yorker to get another agency to print out a document and verify it—only to have that agency scan it and store it in their own files.

The ability to have a record sent upon request from one City agency to another is a challenge that technology can easily help solve. No additional fees or documentation requests should be necessary.

Similarly, it should be possible to create a “data locker” that can upload and store third-party records. Many providers—such as banks and hospitals—have established consent frameworks that allow individuals to authorize others to access certain data for specified purposes. An entire industry has emerged to streamline expense reporting for the employees of private companies, which involves in many cases linking credit card records, travel documentation, and uploaded forms. Third parties have also begun to develop reports that seek to satisfy public benefits verification requirements by creating these linkages where the government has not. For example, the Workers Lab partnered with early-stage fintech company Steady to develop an app that allows gig economy workers to link their gig platform and financial accounts to prepare an income report that meets state verification standards for unemployment insurance.<sup>14</sup>

To create an effective and secure data locker would require City agencies to provide a new option for document requests that allows the requester to ask that the documents be sent online directly to the relevant agency as part of their application. Alterna-

tively, a data locker could be created that both agencies can access for specific reasons and with only limited rights, as in a shared drive. To ensure user control over this data, individuals would still need to authorize agencies to access each document as needed. But this kind of check-box approach would be far simpler than obtaining, photographing, and uploading paper documents, as is generally required today.<sup>15</sup>

NYC Opportunity is already working on a pilot that tests this very concept. Over the last two years, in partnership with New America Foundation and the NYC Office of Homeless Services, NYC Opportunity developed a digital data locker solution to facilitate more efficient sharing of core documents required in benefits applications between clients and caseworkers. This free, simple, and easy-to-use system will allow clients to upload, store, and control access to their documents. Following user-centered design best practices, NYC’s My Digital Data Locker is being developed first as a pilot for residents living in NYC Department of Homeless Services shelters, incorporating feedback from users, practitioners, and researchers. Other cities are also experimenting with this technology. In March 2021, the City of Baltimore Mayor’s Office of Homeless Services launched the My Digital Data Locker Baltimore pilot for residents applying for Baltimore City’s Rapid Rehousing program.<sup>16</sup>

A data locker is one way the City can get around the legal and programmatic challenges that make it difficult for agencies to share data seamlessly to enable prequalification or a one-stop-shop for benefits. Several City-administered programs are funded by the federal and state governments, for example, which impose restrictions on what the data can be used for. In many cases, eligibility standards are similar but not the same across different programs, simply because those programs are established by different laws at different levels of government. While standardizing and streamlining these would benefit New Yorkers, doing so is likely beyond the power of the City.<sup>17</sup>

Reconciling the standards, processes, and data formats among City agencies, however, is within the City’s control, and is susceptible to a combination of technology innovation and interagency cooperation. City agencies have different standards for collecting

and storing data, and different approaches to reviewing and verifying documents, different legacy technology systems, and different user interfaces, accounts, and logins. In some cases, the data locker will solve these discrepancies, but improving the experience for New Yorkers will also require standardization across these other aspects of agency processes.<sup>18</sup>

## An agenda for the next administration

The next Mayor should move aggressively to build on the successful work of NYC Opportunity and HRA, making it much easier for New Yorkers to apply for benefits and conduct other interactions with the City. The three highest-leverage steps we have identified are listed below.

### 1 Create secure and easy-to-use personal data lockers to store eligibility-related documentation

The next Mayor should ensure that NYC Opportunity has the funding and support to finish its personal data locker pilot, then move aggressively to scale the solution as soon as possible. While a cautious approach to new systems handling sensitive data is warranted, it should not take years for the City to roll out a data locker to all New Yorkers. Further, while the most urgent need for such a solution is in helping New Yorkers who need social services to complete their applications with ease, the concept can be expanded to cover all New Yorkers who have interactions with the City, whether as taxpayers, as individuals placing requests with 311, or in any other setting requiring the completion of forms. The personal data locker could even become a digital token that would allow a privacy-protecting approach to having a single dashboard on which a New Yorker could manage all of their interactions with the City. Finally, the City should move quickly to develop electronic standards for important documents, so that what is held in the locker is not, for

example, a scanned copy of a paper birth certificate, but rather a native digital certificate that can be verified electronically.

### 2 Streamline benefits applications across agencies, beginning with the user interface for online applications

The next Mayor should move aggressively to require City agencies to standardize their websites, login systems, standards for eligibility verification, user-facing forms, and inward-facing data schema. This can and should be a priority for the new Deputy Mayor for Technology and New York Digital Service proposed elsewhere in Chapter 1.2, Administration. The effort would build on a recommendation from the City's 2018 report that recommended consideration of a "Digital Application Service" to serve as a central resource, providing support and design tools to help agencies move from paper or web-enabled forms to online applications.<sup>19</sup> At a bare minimum, every agency should have an online application format, and it should be compatible with the new data locker. Further, agency forms should have standard terminology and a standard look and feel so as to assist New Yorkers who need to interact with multiple City agencies. Fundamentally, City agencies will need to be willing to put users first, rather than their own bureaucratic processes.

Because this is the kind of interagency process that is difficult and often susceptible to bureaucratic inertia, it is likely that the City Council will need to enact a mandate for this work, and make it a focus of regular oversight hearings. This kind of visibility should be helpful to the work of a new Deputy Mayor for Technology. Similarly, when the Comptroller reviews City contracts that include the creation of websites and/or data handling, a criterion for consideration should be whether the contract includes a requirement to align as much as possible with other agencies, especially those who serve similar groups of New Yorkers.

### 3 Add a feature to ACCESS NYC that allows New Yorkers to keep track of their City programs and when they need to reapply

A frequent concern is that benefits-eligible New Yorkers lose their benefits because they need to renew their eligibility periodically, but are not aware of their renewal deadlines. Managing these renewals can be a burdensome task for someone involved in multiple City programs—just as any parent of multiple children knows that keeping track of permission slips and forms they need for school can be complex. Currently, ACCESS NYC does not keep track of what programs a New Yorker is enrolled in or what their status is. While some interagency data sharing can run afoul of federal and state restrictions, it should be possible to create a tool that does not share such information across agencies, but merely consolidates it in the users' mobile phone through separate, privacy-protected queries. The next Mayor should direct the Deputy Mayor for Technology and NYC Opportunity to ensure that such a feature is included in an update of ACCESS NYC, which should be feasible within 12 months.

## Privacy and equity concerns

The goal of these recommendations is to fundamentally improve equity by making it easier for New Yorkers to access the benefits they are eligible to receive, benefits which have been proven to reduce poverty rates for those recipients.

A key equity concern—that not all New Yorkers have easy access to the internet—should be partially alleviated by the recommendations in chapter 2.1, Broadband. However, New Yorkers should not be forced to use the internet when it may be less comfortable for them, due to language, visual impairments, or personal preference. None of these recommendations should be construed to suggest eliminating the options of paper applications and phone support.

The overall goal of the consent framework is to protect privacy by giving the user control over their own personal data. However, cases may arise when

out-of-date information is inaccurately kept in the data locker. To ensure the data locker does not cause applicants to be denied benefits for simple errors, they should have the opportunity to respond to caseworker questions or denials and correct any issues.

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## 4.2 Make Community Boards more representative by holding hybrid and virtual meetings, using digital tools to broaden their reach and expand access

New York's 59 Community Boards are a critical component of the City's government, providing the link between a large, consolidated municipal government and the neighborhoods in which we live and work. However, it's widely understood that our Community Boards are not fully representative of their neighborhoods, in large part because the simple act of attending evening meetings that can run up to several hours long prevents many New Yorkers from participating. During the pandemic, though, Community Boards converted to virtual meetings, and generally have seen participation increase as the barrier of physically attending a meeting has decreased. We recommend that Community Boards embrace hybrid meetings, but only after they test and implement best practices, and that they be required to make use of additional features of virtual meetings, such as automatic closed-captioning, computerized translation into multiple languages, and alerts for when specific topics are discussed. With consistent standards and the equitable distribution of resources to enable the shift, virtual and hybrid meetings can broaden participation and increase the representative nature of Community Boards.

### The problem we face

One of the foremost ways residents can get involved in the decision-making processes affecting their lives is through public meetings. In New York, the City's 59 Community Boards serve as the most local form of government, and are intended to provide an easily accessible gateway for this type of grassroots participation. Initiated as part of Jane Jacobs's campaign

for decentralization and devolution of power in the 1960s and expanded by a voter referendum in 1975, Community Boards are designated as the required local entities for consultation by city agencies and play a formal advisory role in many of the City's administrative decisions, ranging from parking rules to zoning variances to budgeting.<sup>1</sup> The 50 volunteer members of each Community Board are appointed by the Borough President and Council Members, but a significant portion of each Community Board meeting is devoted to hearing from members of the public. While Community Boards don't have the formal ability to block an agency decision, their role as the official and most local forum of a given neighborhood often allows them to shape public perception of projects and in many cases the ultimate fate of many decisions.

However, the reality is that Community Board meetings and other public meetings hosted by government agencies are often unrepresentative of their neighborhoods.<sup>2</sup> Membership on Community Boards across the city skews generally whiter, older, and more male than the populations the boards represent.<sup>3</sup> In part, this phenomenon is rooted in existing patterns of political connectedness. But the disparity also stems from the simple fact that full participation in a Community Board requires a significant time investment to prepare for and attend meetings, with a total commitment of about 10 hours a month.

As a result, in order to ensure that Community Board decisions reflect the diversity of perspectives in the neighborhood, it is imperative that a wide spectrum of the public participate by commenting in scheduled



“Community Board meetings and other public meetings hosted by government agencies are often unrepresentative of their neighborhoods.”

Community Board meetings. However, attendance at these meetings has been limited in part by the fact that they are in-person meetings that generally take place on weekday evenings. Barriers to access leave many New Yorkers unable to attend. These barriers, especially onerous for older people and people with disabilities, include venues without assistive infrastructure; the City’s many inaccessible transit routes; and a lack of hearing loop technology. For other New Yorkers, the realities of travel time, caregiving duties, or evening work hours create even more barriers to participation. As a result, people with high levels of awareness, free time, and special interests are likely to attend in-person meetings at disproportionately higher rates, and their views are thus disproportionately represented. This conundrum has prompted increased criticism of Community Boards as institutions, and led to calls for City agencies to give Community Boards less influence in their decision making.<sup>4</sup>

The shift to online meetings forced by the pandemic, however, resulted in an unexpected and welcome expansion of participation in Community Board proceedings. On March 7, 2020, the Governor of New York issued an executive order that, among other things, suspended aspects of the Public Officers Law, opening the door for remote meeting attendance.<sup>5</sup> After years of fruitless advocacy by accessibility and transparency advocates alike, remote participation became the standard instead of the exception almost overnight, by necessity.

Almost universally, online accessibility has increased participation in Community Board meetings. “We saw Community Board meetings go from what would normally be, maybe, 100 people in a room, to consistently a couple hundred people coming to full board meetings,” said Noel Hidalgo, executive director of

BetaNYC, which supported a number of Community Boards in their transition online. “There were a few contentious Community Board meetings where there were over 1,000 people in attendance.”<sup>6</sup>

For this report, we surveyed Community Board district managers and staff. Although record-keeping of public attendance is sporadic, of the respondents with observational or attendance data, 13 of the 14 Community Boards we questioned reported that virtual meetings have increased or greatly increased public turnout and engagement at their meetings.<sup>7</sup> One noted, “We are seeing more parents of young children, more youth, more cross-city interest, and yes, larger numbers of people since capacity is no longer an issue.” Another pointed out, “Through virtual meetings we have been able to attract/engage the Chinese speaking community in higher numbers. My best guess is that the age range is between 25-45, an age group that has been hard to engage through in-person meetings. Whether due to work or family schedules, it seems that more people in this age group can jump on the computer for a meeting.”<sup>8</sup> Manhattan Community Board 6 ran a survey about remote meetings and found that more than half of all respondents had not interacted with CB6 until Zoom allowed them to do so.<sup>9</sup> Other district managers cited not having to postpone meetings due to weather, and having turnout that never dipped below the numbers required for quorum, as additional benefits of virtual meetings. One Community Board reported that members of the public also regularly cross-syndicate the board meeting videos to Facebook, where they gain further viewership.

The value of online CB meetings became apparent on June 24, 2021, when then-Governor Andrew Cuomo hastily ended the emergency declaration,<sup>10</sup> forcing CBs, like other public meeting entities, to scramble to find safe space for in-person meetings. Many elected officials in New York City were concerned by the implications for public safety and lobbied to have the ability to meet virtually extended for CBs. “We need the State Legislature to amend the Open Meetings Law (OML) to enable agencies to hold virtual or hybrid meetings,” wrote Manhattan Borough President Gale Brewer to newly installed Governor Kathy Hochul in August. “The resumption of the OML has caused some challenges and confusion. Many CBs cannot find meeting space that accommodates 50 CB members, staff, and neigh-

borhood residents.”<sup>11</sup> In response to these concerns, Governor Hochul signed legislation extending the authority of local government entities to hold virtual meetings through January 15, 2022.<sup>12</sup> This extension, however, is temporary by definition, and linked to the pandemic. It does not solve historic access problems in the long term.

It is important to note that despite their advantages, virtual meetings are not a panacea. While many Community Boards reported expanded engagement due to virtual meetings, one shared that “it is still not an audience that is representative of [our] demographics.” As discussed in Chapter 2.1, Broadband, 16% of New Yorkers lack any internet connection at home, and 29% do not have broadband access at home.<sup>13</sup> While people without digital access can still dial into meetings by phone or submit written statements, they lack access to the full visual and audio meeting experience. Online meetings by their nature present inherent challenges related to cybersecurity.<sup>14</sup> And the way the law is currently written raises some logistical concerns about what kind of access the public should have to spaces, including private homes, from which board members are attending virtually.<sup>15</sup>

Further, shifting to successful online meetings required significant effort from administrators and participants, which was in many instances facilitated by advocates and nonprofits.<sup>16</sup> Core to the success of Community Boards’ transition was the longtime work of New York City’s leading civic tech group, BetaNYC, which has long advocated the greater use of technology to expand participation, and worked directly with Community Boards to assist their use of technology.<sup>17</sup> In response to the pandemic, BetaNYC worked with Manhattan Borough President Gale Brewer’s office to rapidly review the available video conferencing solutions, help boards procure Zoom licenses, and train Community Board meeting chairs and members in best practices.<sup>18</sup>

The imminent expiration in January 2022 of the extended virtual meeting provision will likely refocus attention on this issue. While some will argue for a return to “normal,” fully in-person meetings are likely to cause a severe drop-off in participation. However, the temporary approach of the pandemic period cannot be accepted as permanent; not all meetings should be virtual in the future, and some combination of

hybrid, online, and in-person meetings will serve the public best in the long run. Finally, many assume that hybrid meetings—with some participants gathered in person and others virtual—offers the best of both worlds, but increasing experience within corporate settings demonstrates that hybrid meetings can be highly unproductive and highly unequal if they are not managed well.<sup>19</sup>

To realize the full value of technology in ensuring access to the public forum provided by community boards, the City will need to build a new set of community board practices that make full use of the technology and do so in an intentional way.

## The technology opportunity

Virtual and hybrid meetings raise their own challenges of ensuring equal access, but they also offer additional tools, as yet untapped, to draw in still more New Yorkers.

The first of these is automated transcription. The machine learning technology required to transcribe spoken conversations into text automatically and in real time has improved dramatically in recent years. Over the same time period, its cost has fallen to the point of free or nearly free; real-time transcription is a free feature in Windows, Apple, and Android operating systems. YouTube videos can be automatically captioned by the platform, albeit not in real time. A bevy of third-party vendors offer enterprise-level solutions for real-time transcription.

Real-time transcription allows automated closed captioning. The text of what the speaker is saying is displayed visually, overlaid on the video feed from the meeting, nearly instantaneously after the words are spoken. Captions benefit many groups in addition to those with hearing loss—including, for example, multilingual residents and people watching the meeting in noisy environments. People attending the meeting physically in person could also make use of the caption service.

Speech-to-text transcription also allows real-time translation of meetings from English into many of the hundreds of languages New Yorkers speak. Similar

“Captions benefit many groups in addition to those with hearing loss—including, for example, multilingual residents and people watching the meeting in noisy environments.”

advances in machine learning have greatly improved free automated translation services just as they have speech recognition. Given New York’s multilingual population, the ability to have real-time translations of a Community Board discussion, and even the ability to speak in a Community Board setting in your preferred language, could have a transformative effect on the ability and propensity of non-native English speakers to participate in meetings. While not a substitute for other forms of multilingual outreach, real-time translation can unlock the actual meetings for a much broader population.

Real-time transcriptions also facilitate public record-keeping needs where required, leading to detailed records at a very low cost in terms of fees and labor. The civic startup Block Party is already leveraging YouTube’s automated transcription feature to generate transcripts of both contemporary and past meetings, creating a valuable archive of public discussions for researchers, historians, and advocacy groups. The City of New York’s own departmental outreach teams can use these transcripts to evaluate whether their issues are appearing on local neighborhood agendas, and adjust their outreach accordingly.

Real-time transcription also makes it possible for New Yorkers to engage around their personal needs and interests more easily. In 2014, civic startup Mind My Business invited small business owners to simply enter their business’s street address in order to subscribe to alerts about government decisions affecting their location, including everything from zoning changes to temporary street closures. The startup’s founder, Aileen Gemma Smith, shared that the service attracted

## Block Party publishes Community Board meeting highlights

Civic startup Block Party takes the free meeting transcripts provided by YouTube, improves them with NYC-specific machine learning classifiers, and shares the meeting highlights in free Community Board newsletters.

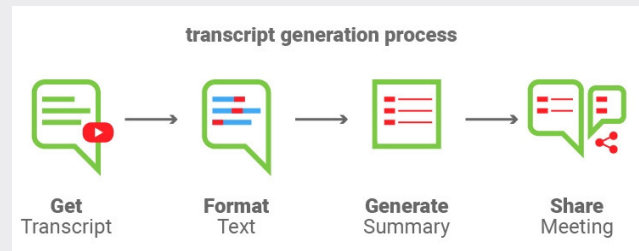


Image credit: Block Party.

thousands of users across all five boroughs: “A significant portion were active daily. Folks liked the ease of use. We were able to provide targeted business-specific data with shopkeepers only giving us their business name and address.”<sup>20</sup>

Mind My Business’s success illustrates the fact that most New Yorkers have specific things that interest them, but do not have the time and attention to watch Community Board agendas and meeting notices. However, with transcriptions, New Yorkers could sign up for alerts that would notify them when published agendas or discussions touch on things they are interested in, such as their child’s school, the street they live on, their park or bike lane, or a business they either support or have a complaint against. With such a service, the likelihood is that more New Yorkers would be able to stay abreast of Community Board discussions that interest them and would be more likely to participate as a result.

Finally, multiple options exist to address the challenges of those who do not currently have broadband access at home. The first is to ensure that dial-in, audio-only phone access is always available for video meetings. The second is to offer locations where a public computer is tuned into the meeting; while this was obviously not an option during the pandemic, it could be done through public libraries, schools, senior centers, and other locations. By having multiple locations like

this for every Community Board meeting, even those New Yorkers who do have to travel to attend a meeting could be given more convenient options to do so.

Ultimately, of course, the necessary solution to the digital divide is to bring all New Yorkers into the digital economy. This was already a priority of the de Blasio Administration, and is receiving significant attention in Albany and Washington. We cover the topic in Chapter 2.1, Broadband.

## An agenda for the next administration

The next Mayor, City Council, and Borough Presidents of New York have the opportunity to lead. Post-pandemic, Community Boards should continue hosting hybrid meetings that promote virtual participation. Not all meetings can or should be fully virtual, but none need any more be fully in-person. By extending the option to virtually attend public meetings, and eliminating other barriers to participation through transcription, translation, and alerts, New York City will foster a more equitable government. Continuing to broaden public participation in collective decision-making will drive greater political legitimacy. However, it must be done with a recognition that virtual participants must be treated as full participants, which will require discipline and attention in the rules that are adopted and the practices followed. We have a rare opportunity right now to secure the accessibility gains prompted by this once-in-a-century crisis, and to leverage technological advances to make it far easier for New Yorkers to stay abreast of, and when meaningful to them, engage in, local decision-making.

Reaping the full benefits of hybrid meetings will require a concerted approach, one that is more intentional and more complete than the heroic but nonetheless emergency-driven switch to online meetings that took place in early 2020. It is also vital that community boards receive the financial and operational support that they need to implement hybrid and virtual meetings smoothly and effectively, so that this does not become an unfunded mandate resulting in inequitable results across different parts of the City.

## 1 Advocate for Albany to amend the Open Meetings Law to allow continued virtual and hybrid public meetings after the pandemic

The Open Meetings Law, Article 7 of the Public Officers Law, governs the way public meetings are conducted across the state, and defines meetings as physical gatherings.<sup>21</sup> Community Boards and other entities were initially granted the ability to hold virtual meetings by Governor Andrew Cuomo's Executive Order 202.1, which justified a move to remote public meetings by the state of emergency created by the pandemic.<sup>22</sup> In fall of 2021, Governor Kathy Hochul extended the provision for virtual meetings into January 2022.<sup>23</sup>

The Public Officers Law needs to be amended so that voting members attending virtually will count towards quorum and be able to vote without having to open the venues where they are logging in from (i.e., their private residences) to members of the public. Currently, even if a voting member of the meeting is physically prevented from attending by medical necessity, their remote participation cannot be counted (except under Executive Order 202.1). Public officials such as Manhattan Borough President Gale Brewer and Queens District Attorney Melinda Katz have been leading this cause to date.

The next administration should also ensure citywide compliance with Local Law 103 (known as "the webcasting law").<sup>24</sup> Sponsored by then-Council Member Gale Brewer and enacted in 2013, the law already requires each "city agency, committee, commission and task force and the council" to record public meetings and publish the recordings online within 72 hours and, "where practicable," to stream the meetings online.<sup>25</sup> The law excludes Community Boards from the requirement, but it should be updated to include them (and the Community Boards should be provided with the requisite technology and resources to comply with this mandate, as discussed). The City can help achieve this milestone by appointing a single agency, such as the Law Department, to be responsible for driving compliance with Local Law 103, and by providing

## What will it take to keep livestreaming Community Board meetings?



### Amend

New York's Open Meetings Law to enshrine the right to remote participation



### Equip

New York City's 59 Community Boards with the resources they need to host virtual and hybrid meetings



### Fund

Borough Presidents Offices to adequately support ALL Community Boards in procuring meeting software, venue connectivity, and A/V equipment



### Train

Meeting administrators and volunteers in virtual/hybrid meeting best practices, including privacy and cybersecurity needs

the requisite technology through DoITT or another agency (rather than providing funding, which might be diverted to other budgets).

## 2 Provide Community Boards with user-friendly, standardized webcasting kits

Community Boards are chronically under-resourced, and will need support in order to host hybrid and virtual meetings. One key challenge with the transition to virtual meetings was that it was done piecemeal, with Community Boards left to figure out how to make the transition on their own. This led to disparate results across the City. In Manhattan, the Borough President's office funded virtual meeting solutions for the borough's 12 Community Boards, at the cost of close to \$1,500 per district.<sup>26</sup> Other boards, such as those in Brooklyn, were left to fund and procure virtual meeting technology licenses on their own.<sup>27</sup> With only one tech support person covering all 59 Community Boards, BetaNYC stepped in to provide additional literacy and training support for staff and members.

Navigating a wide variety of virtual meeting solutions and hardware<sup>28</sup> makes participation more difficult for everyone. According to BetaNYC Executive Director Noel Hidalgo, "You need meeting software licenses to host meetings and webinars. You need good broadband, microphones, cameras, and rooms that allow for a good

audiovisual experience. Community Board members themselves need decent computers, internet access, and headsets at home to participate in a way that doesn't disrupt the meeting. There's a whole cascading set of issues that present themselves."<sup>29</sup>

To meet these challenges, the City, through DoITT, other agencies, and the Borough Presidents' offices, should provide adequate funding and procurement support for virtual meeting software licenses, streaming devices, venue connectivity needs, and virtual meeting training through grants to a community partner like BetaNYC. Packaged into a standard "webcasting kit"—an idea promoted by the City's first Chief Digital Officer, Rachel Haot—these tools could then be provided at competitive rates with less administrative overhead. Uniform tools and standards also make training easier for both administrators and users.

A user-centered webcasting kit should ensure that the needs of users, not IT specialists, drive the selection of the tools. One reason for the success of the Manhattan Community Boards' transition to virtual meetings was that BetaNYC assisted the Borough President's office in the selection of the software. This led to the selection of Zoom, which had already become the overnight standard among the private sector, instead of solutions that are often preferred by IT departments, such as WebEx. Making sure the webcasting kit is developed with an emphasis on user-friendliness may well determine the success or failure of virtual meetings.

That's why it will be important to use the initial implementation period to experiment with tools, and to iterate based on feedback from CB administrators and board members, as well as members of the public.

### 3 Use 2022 as an experimental period in which to iterate and refine best practices

A shift to hybrid isn't just as simple as installing a computer screen in the old meeting room.<sup>30</sup> Even before the pandemic, there was increasing awareness that people joining an in-person meeting virtually are at a disadvantage. That's why thoughtful companies developed practices such as allowing virtual participants to speak first and prohibiting cross-talk and side conversations in the meeting room. After the pandemic, the challenges of hybrid meetings have led some companies to ban hybrid meetings altogether—requiring people to join from their own devices even if they are in the office.

Community boards, noted often for their lack of discipline, could fall into patterns that exclude virtual participants if hybrid approaches are not developed thoughtfully and intentionally. To address this possibility, and to foster the development of equitable hybrid-meeting protocols, the City must first designate a period during which CBs are required to adopt a set of different rules, and then ask chairs and participants which ones worked best. At the same time, CBs should retain the discretion to have all-virtual meetings. For example, meetings on particularly contentious topics might better be held completely online to prevent disruptions and crowding; committee meetings (which do not pass final resolutions) could remain all-virtual to ensure broad participation.

Regardless, the policies and procedures developed in 2022 should not be considered as a final approach. Instead, we should see this as a period during which CBs attempt to take the best practices that emerged in 2020-21 and use those as a foundation for an intentional new normal.

“Digital government should have a ubiquitous and unified user interface.”

— Noel Hidalgo, BetaNYC Executive Director

### 4 Upgrade meetings with automatic transcriptions, captions, and translation to improve accessibility

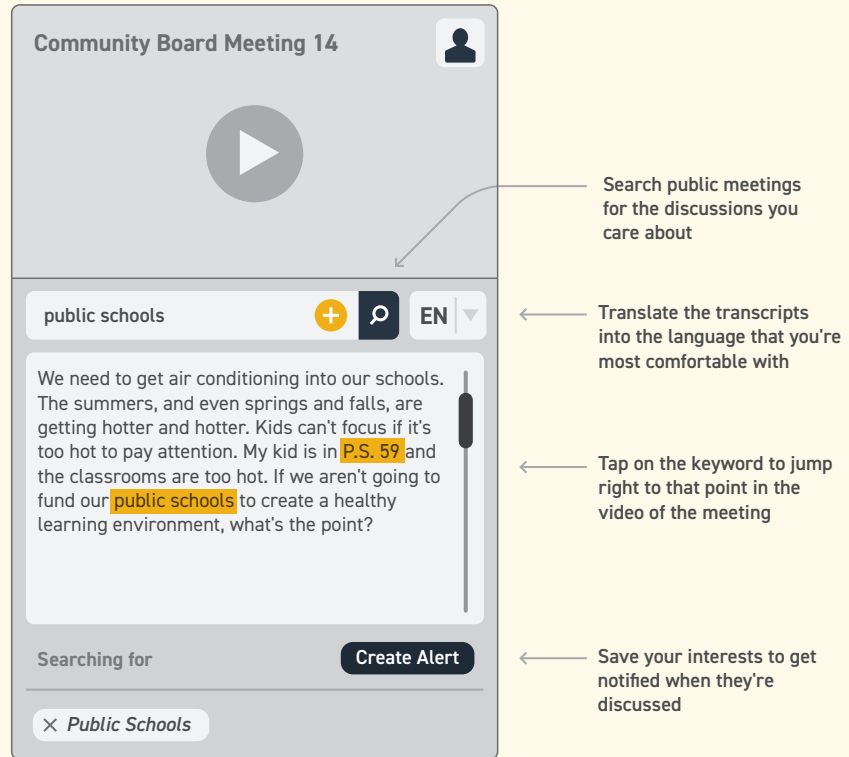
The standardized webcasting kit also allows the City to establish regulations for the additional services based on machine learning that videocast meetings allow. The kit should include an automatic transcription service, and should allow transcripts of Community Board meetings to be added almost immediately to *The City Record Online*, the City's official government archive. As a municipally controlled archive, the *City Record* is a superior alternative to private platforms (such as YouTube) where the data may not be kept forever and where the City might lose control of its own records. A reasonable process for checking automated transcripts will be necessary, presumably relying on a Community Board's Secretary to review the draft transcript in a timely manner, and the District Manager to ensure that it is uploaded.

Speech-to-text transcription of public meetings also opens the possibility of interactive transcripts. This growing field of multimedia software allows additional creative interoperability with the words spoken in meetings. People can search a meeting recording with a text query, as they would when using any search engine, and find the exact moment in the video where the words were spoken. Someone reading the transcript of a public meeting could also simply tap a word in the transcript to immediately jump to that part of the meeting video.

Similarly, the transcription should allow users to enable closed-captioning (the visual display of what is being said on the screen) and translation (offering those captions in a variety of languages). As noted above, this would be either a free or low-cost feature that would

## Live transcripts of public meetings

A mock-up of how keyword search of video transcripts could work, powering personalized alerts and other accessibility features.



expand access to online meetings to those with hearing impairments, those viewing from noisy environments, and those who feel more comfortable in languages other than English.

The addition of automated speech recognition and transcription to the webcasting kit should not increase costs significantly. Cloud services provided by Rev. ai, Google, Amazon, and others offer relatively low-error-rate transcriptions at \$2-3 per hour of audio.<sup>31</sup> (For context, human-transcribed texts cost over \$50 per hour.)<sup>32</sup> Although YouTube provides captions for free, it only does so 24 hours following a video stream, which is insufficient to achieve this vision.

Additional features could be added to the webcasting kit, especially if it is designed and delivered through effective local partners such as BetaNYC, Block Party, and Red Hook Initiative. BetaNYC's BoardTrack attendance tool and Block Party's automated meeting transcription and meeting highlights newsletters would both create further value, building on the automated transcripts. Further, Block Party's work to train additional machine learning classifiers on language used in the New York City context is invaluable and

should be leveraged to improve the accuracy of discussions about New York City-specific contexts. Finally, to ensure that Community Board staff can implement and manage these systems effectively, the City should invest in the trainings and assistance provided through these local organizations.

## 5 Create an interest-based alert service for New Yorkers

The automated transcriptions could also form the basis for an opt-in service to allow New Yorkers to receive notices based on locations and topics that interest them. In 2013, BetaNYC's "People's Roadmap to a Digital NYC" included the recommendation that such a service be created, building on the existing Notify NYC system. But in the eight years since, there has been no movement on this topic.<sup>33</sup> By making it significantly easier for New Yorkers to pay attention to the topics that interest them, we can expect significantly greater involvement.

## Block Party’s automatic keyword classifier demonstrates how often certain topics come up in a given meeting

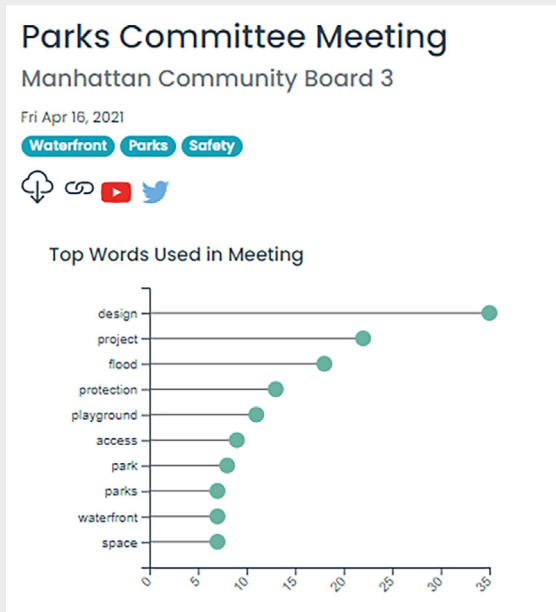


Image credit: Block Party.

The design of the system would allow New Yorkers to enter topics and locations of interest—whether a specific address or entity, or a general neighborhood, or topic such as “gardens”—and to receive notifications when there are City actions that mention or apply to that topic. The automated transcripts of Community Board meetings would be a major source of such information, but so would City Council hearings, legislative introductions, and other processes.

Implementing such a system will require a focused effort, but should not be a major investment of either time or funds. Ideally, this would be done out of an existing City agency (which could be the Department of Records and Information Services, DoITT, NYC Opportunity, or the CTO’s office), perhaps through a contract with an outside development firm, and in partnership with a citizen user testing group (such as Blue Ridge Labs’ Design Insights Group). The significant challenge would be the coordination between the lead agency and the NYC Office of Emergency Management, which manages Notify NYC, and the creation and maintenance of the data pipelines. These could be based on the *City Record Online* if that becomes the repository for all Community Board transcripts.

## 6 Facilitate and broaden opportunities for community input

Along with training in using the physical tools required to run hybrid and/or remote meetings, CB members should also receive training and support in online platforms that enable members of the public to communicate their hopes and concerns about their neighborhoods. The Peoples’ Tech Assemblies (PTA), an initiative of the Public Advocate’s office,<sup>34</sup> has been developing such mechanisms. But unless CB members know how to make use of them effectively for community outreach, the tools will not fulfill their purpose. For instance, PTA partner BetaNYC offers a service called Research and Data Assistance Requests (RADAR),<sup>35</sup> designed to help CBs and similar entities, such as Citywide Education Councils, to meaningfully access open data and public information for the purpose of informing and educating constituents about issues affecting their lives. Without proper training, however, these tools will remain obscure and won’t be leveraged effectively.

### Privacy and equity concerns

Because participation in a CB meeting is a very public act, we have not identified any privacy issues with the transmission, capturing, or indexing of what is said during CB meetings.

There are potential equity issues raised by this proposal because access to broadband is correlated to income and ethnicity. Because Community Board membership and participation has traditionally skewed towards older, higher-income, and white groups compared to the population of their districts, our tentative conclusion is that the broader participation afforded by virtual meetings improves equity. Further, we believe that the translation capabilities of transcribed meetings would also enhance equity by making meetings more accessible to those who are less comfortable in English. However, we have not been able to obtain sufficiently detailed data on participation that would allow us to demonstrate these findings conclusively.



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## 5 Futureproofing: Position NYC to shape the urban technology of the future

From mobile phones to Airbnb, from LinkNYC to Citi Bike, new technology has changed New York City dramatically over the last 20 years. With 5G technology on the horizon, the pace of change in cities will only accelerate further. Innovations such as autonomous vehicles, new social media platforms, and machine learning for building management make it a safe bet that new urban technology will affect New York City as much over the next 20 years as it has over the last 20.

New York City has not, to date, done an excellent job of getting ahead of new technologies and the businesses that deploy them in the urban context. It must learn to do so. New Yorkers need to be well-positioned to shape the way urban technology arrives in the City. They should not be the targets of corporate expansion strategies, but rather willing and empowered partners in how urban technology evolves. Further, New York has the potential to shape the future of urban technology. If New York City can establish what it wants new technology to do and not do, it can help guide innovators to create urban technology that serves the greater public good, not just consumers and investors.

## 5.1 Develop rules that shape and encourage emerging technologies in advance of their arrival

New York City has struggled to regulate new technology, a shortcoming that has at times allowed new entrants to dictate terms, required draconian countermeasures, and delayed the deployment of useful technologies. This lack of planning has also wasted the potential that New York City has to be proactive and shape the evolution of urban technology. The next Mayor and City Council should enact rules that anticipate the use of technologies that are about to arrive, such as drones and autonomous vehicles, and create a standing panel to report periodically on emerging technologies and their regulatory implications.

### The problem we face

In the last decade, technology has transformed many aspects of life in New York City. Ride-hail companies like Uber and Lyft have changed transportation patterns. Airbnb has changed the way visitors stay in the City, in the process affecting both the residential rental market and the hotel industry. E-commerce has changed retail economics. Digital advertising screens and Citi Bike docks have changed the streetscape. Ubiquitous internet access has changed the way we navigate our city—and even the way we walk through it. Facial recognition technology has changed policing, and promises—or threatens—to change many other interactions as well.

The reality is that New York City has not managed many of these changes very well. New business models arrived well before there was a regulatory framework

around them. As a result, these enterprises established themselves as “disruptors” whose operations were shaped by their own business interests, rather than being harnessed to improve urban life. The subsequent battles around what rules should govern them were therefore hard-fought, bitter contests that did not lead to ideal outcomes for anyone.

Perhaps the best known instance of this is the de Blasio Administration’s multiyear fight with Uber and Lyft. At first, the City did not act aggressively to shape how the two disruptors entered the market. Then, perhaps at the behest of taxi fleet owners and financial institutions that financed medallion purchases, the de Blasio Administration sought to restrict Uber—only to find that most New Yorkers welcomed the ride-share company. Only after it had gained a dominant position in the City’s for-hire industry, and individual owner-operator taxi drivers had experienced crushing losses, did the City act decisively. Even then, it did so coarsely and in a way that invited losses in court.<sup>1</sup>

New York City’s experience with Airbnb followed a similar trajectory. When Airbnb first entered the market, it was technically illegal, but went basically unregulated. As it quickly grew, it created a group of New Yorkers who were keenly interested in allowing it to continue operating. Those New Yorkers were often effective advocates, especially because the company hired lobbyists and marketers to help amplify their voices. Only later, when Airbnb’s impact on the City became impossible to ignore, did the politics change. Then the City was able to impose regulations, which were perceived as severe. In part, however, those limits

were transparently driven by a desire to please vocal incumbents rather than New Yorkers in general.<sup>2</sup> Then the City lost an important court case, which will stymie its ability to regulate Airbnb. Although the COVID-19 pandemic has put this struggle to the side, the issue will almost certainly flare up again when more normal travel resumes.

Facial recognition technology is currently on the same path. Its significance was not generally recognized when the New York Police Department began using it in 2011, fully a decade ago. Only over the last few years have the downsides of facial recognition become widely understood: its unreliability, especially when used to surveil people with darker skin; its potential use, or misuse, by landlords and others engaged in practices that violate contextual privacy standards; and the uncertainty about who has knowledge of what searches have actually been run. As a result, New York is now banning the technology. In contrast, the state of Massachusetts has developed procedures around the use of facial recognition for appropriate reasons by specific personnel, and specifies that results should be relied upon only to the extent that they can be verified.<sup>3</sup> Meanwhile, New York and other cities have thus far passed up an opportunity to indicate to the market what standards are required in order for facial recognition to be embraced.

The City's reaction to e-scooters has veered in the other direction. While Bird, Lime, and other e-scooter companies were popping up across American cities in 2017 and 2018, New York State and New York City Department of Transportation (DOT) took an extremely cautious approach—in part due to the City's past experience with Uber and Airbnb.<sup>4</sup> As of November 2021, New York's DOT has only approved a highly controlled pilot deployment of e-scooters in one section of the Bronx. While such an approach will certainly mitigate the risk of negative impacts, it will also ensure that New York City will lag more than five years behind other cities in full-scale deployment of scooters.<sup>5</sup>

These tortured interactions were not inevitable. In most cases, City officials saw them coming. The City Council often held hearings on new technologies in advance of their arrival. The problem has been that

neither City officials nor City Council staff have been able to figure out the real risks and benefits quickly enough to act with confidence.

Mayoral agencies have been outspoken on various technologies, but have generally been hesitant to recommend early action. With respect to drones, for instance, City officials have cited the fact that rules for identification and flights in urban areas are under development by the Federal Aviation Administration. With respect to autonomous vehicles (AVs), DOT has argued before Congress that cities must be included in the development of federal AV regulations. But, New York City has not adopted laws governing the deployment of AVs on City streets out of concern that once state and federal rules are enacted, they will preempt City laws.

The City's task force on Automated Decision Systems (ADS) seems to have failed for a similar reason: the agency that led it was unwilling to countenance aggressive action. The task force was convened as a compromise to forestall a more aggressive piece of legislation on algorithmic tools the City uses to make decisions that might incorporate bias. But the group met only a few times before issuing a report, written by City Hall staff, that was widely panned by task force members—some of whom argued it reflected only the perspective of the mayoral agency that chaired and staffed it.<sup>6</sup>

Finally, while the City Council has often provoked discussions of early-stage technology, it has not acted in advance of those technologies' arrival in the City. For example, the City Council's first hearing on drones was in 2015, but subsequent action has generally been limited to mandating studies to be undertaken by mayoral agencies.<sup>7</sup> The Council has acted forcefully on its own initiative only in reaction to egregious violations—and then it has often overreacted, as in its efforts to ban e-bikes and punish their users. Many actions have tended to regulate very narrow uses of technology, as in the case of a recent law regulating retailers' use of facial recognition.<sup>8</sup>

The City's inability to get ahead of technology also increases the likelihood that Albany, rather than City Hall, will decide how urban technology is rolled out in the City. Despite their claims to be eager to help cities, a

variety of urban technology companies have sought to disempower municipal governments by seeking state-level laws and regulations that override local laws. The national strategy for both Uber and Lyft was to work at the state level to preempt local laws; this did not work in New York in part because there was the existing framework of Taxi & Limousine Commission regulation of for-hire vehicles.<sup>9</sup> Urban technology companies are likely to replicate this strategy in the future. For example, companies that operate sidewalk robots have been working with state legislatures to prevent city governments from regulating them.<sup>10</sup> In the absence of thoughtful city-level regulation, the arguments of new entrants will sound stronger in state legislatures.

## The technology opportunity

If all of this were in the past—if urban technology were now stable—these shortfalls in the City’s process might not require action. But urban technology continues to evolve. Autonomous vehicles are already in revenue service in the United States. Drones are now flying in New York City, even if illegally. Sidewalk robots are a reality; and new technologies are reshaping consumer purchases and urban planning. Failing to fix the regulatory process will condemn New York to repeat the missteps of the last decade of urban technology.<sup>11</sup>

The even greater risk is that New York City will continue to miss its potential to shape the way urban technology evolves. For any truly urban technology, New York is the largest market in the United States and one of the largest markets anywhere; the media attention it commands means that a New York launch is one of the most closely watched stages in any tech business’s evolution. The ability to gain a foothold in the New York market is tremendously valuable for any urban tech business.

As a result, new technology companies will be willing to work with New York City, as long as it has reasonable rules that create paths for the technology to be implemented safely and in the public interest. An outright ban, or a message that says, “wait a few years,” is not something that an innovative company can work with; communicating instead, “Here’s what we need to see from you, and then we’re eager to be helpful,” can foster cooperation.

“The even greater risk is that New York City will continue to miss its potential to shape the way urban technology evolves.”

The challenge is that neither City agencies, nor the Mayor’s office, nor the City Council, are well equipped to do what needs to be done: identify early technologies; explore their implications without falling prey to the biased arguments of either incumbents or startups; and identify a set of interests that reflects the City as a whole.

This problem is not unique to New York. Boston and London have been successful in adopting and promulgating principles for new urban technologies, and entities like the Los Angeles Department of Transportation have outlined objectives and implications of new technologies. But none of these have gone so far as to actually write regulations in advance.<sup>12</sup> In Britain, Nesta, an innovation foundation that works closely with the government, has advocated for an approach called “anticipatory regulation,” and is actively undertaking a project to work with several British cities to identify ideal local rules for drone deployment.<sup>13</sup> In the United States, the Aspen Institute’s Center for Urban Innovation and the Harvard Ash Center have both explored ways that cities can regulate technologies without stifling innovation.<sup>14</sup>

In other fields, however, the City has tapped external entities to help shape policy. In 2008, Mayor Michael R. Bloomberg and Council Speaker Christine C. Quinn sought to update New York City’s building codes to promote sustainability. They recognized that while the Department of Buildings (DOB) of course had deep expertise in the codes, DOB staff might not have experience with the challenges that existing rules presented for green building practices, and might naturally incline towards the status quo. They also recognized that while environmental advocates, green tech producers, and the real estate industry all had expertise critical to the endeavor, they also all had particular interests that were not completely aligned

with the public's. As a result, Bloomberg and Quinn commissioned an outside entity, the Urban Green Council, to lead an effort that tapped more than 200 architects and engineers to identify what should change in the codes. Called the Green Codes Task Force (GCTF), they were assisted by City staff, an industry advisory committee that represented real estate, and environmental advocates who were invited to observe, but not vote. In the end, they produced a report that was widely respected and quickly stimulated action on more than 50 proposed changes.<sup>15</sup>

While the GCTF focused on changes needed immediately, the challenge of planning for long-term impacts of climate change required a different approach. Forecasting climate change's impacts on New York City falls outside the expertise of City government, and reacting wisely to those potential impacts requires both the City and New Yorkers to understand multiple impacts and evaluate uncertainties. In 2007, *PlaNYC* called for an outside entity, modeled on the United Nations's Intergovernmental Panel on Climate Change, to evaluate the science, determine the expected impacts of climate change, and recommend courses of action to the City's government. Initially created by an executive order in 2008 (with external funding from the Rockefeller Foundation), the New York City Panel on Climate Change (NPCC) was instituted by City Council legislation in 2012. The NPCC serves as an impartial, independent, science-based advisory body. Chaired by and composed entirely of researchers, the NPCC is tasked with writing a report every two years that summarizes what the latest research says climate change will mean for New York, identifying implications for the City as a whole as well as for City policies. The NPCC is self-governing, insofar as no City agency chairs its meetings or reviews its findings. Its last report was published by the New York Academy of Sciences.<sup>16</sup>

## An agenda for the next administration

Based on these models, we recommend that the next administration—not just the Mayor but also the City Council—undertake two efforts to get ahead of emerging urban technology.

### 1 Commission one or more external entities to lead a fast process to make regulatory proposals for new technologies that are already entering use in New York City or elsewhere

With drones, sidewalk robots, automated decision-making systems, facial recognition, and autonomous vehicles already in use here and elsewhere, New York City is behind in creating rules and regulations governing their use, and in signaling what types and patterns of uses would be welcome.

To meet this need, the next administration should quickly engage a reputable external entity to lead an effort to recommend laws and regulations for these five technologies. Such an entity should be a reasonably impartial one, such as an academic institution or think tank, a consulting firm, or an advocacy organization that is not directly involved in the topic. Through its processes, the entity should consult with—but not be subject to veto by—City agencies, elected officials, industry representatives, and advocates. Given the potential for state and federal action, involving New York City's representatives in Albany and Washington would also be advisable. City agencies should participate and provide assistance, but this effort must not be under the control of any specific agency. The process will require resources, and will need a budget to succeed. It may be that topics such as ADS and sidewalk robots are different enough that different entities should lead those separate processes.

If these efforts are prioritized, the Mayor and Speaker could certainly identify and contract with such an entity within the first six months of taking office. If the process takes a year, a report could be finished and initial steps acted upon before the middle of 2023.

It is possible that this process would encourage companies with these technologies to enter the New York City market aggressively (or to seek legislation in Albany) in order to create “facts on the ground” to shape the rules that will be recommended. To combat this eventuality, it may be necessary for the City Council to enact a broad, temporary prohibition on the technol-

ogies to be covered, until a date (for example, late 2023) that creates a deadline for the City and City Council to act on the advisory recommendations.

## 2 Create a permanent, independent Emerging Technology Advisory Panel to issue biennial reports to the City on emerging technologies and their implications

While the above recommendation will address those technologies that are already here, new technologies will inevitably emerge in the future. Despite the City Council's foresight in holding multiple hearings on emerging technologies over the years, these seem to be insufficient to shape a clear discourse and consensus around how the City should act on them. What seems to be necessary is an impartial, expert entity that can undertake this work on behalf of New York City.

The City Council should use the NPCC as a model to enact legislation establishing a Emerging Technology Advisory Panel (ETAP) to undertake a similar mission. Its purview would be to issue a biennial report identifying emerging technologies that have the potential for use in an urban context; the early-stage business models they may employ; the interests of New Yorkers both with respect to the benefits and risks of such technologies and their deployment paths; and a set of high-level recommendations for how the City government should react. Published outside of City government, such a document would provide a basis for thoughtful, early action by City agencies, the City Council, and other branches of City government.

Like the NPCC, the ETAP should be designed as an expert panel, not as a constituent assembly. Its work should be held to the high standards of scholarship to make clear its influences and ensure a fact-based evaluation. As with the NPCC, conflicts of interest should be strictly considered: the panel should exclude anyone with a direct or indirect financial interest in the fields they are studying, and no current government officials should be included.

If prioritized by the City Council and the Speaker, an ETAP could be legislated into existence by mid-2022 and convened for the first time by the end of 2022. It could reasonably be expected to release its first report at the end of 2023.

## Privacy and equity concerns

We have identified no privacy or equity concerns with these two recommendations. If implemented, the rules created could have a positive impact on privacy and equity, because the unregulated introduction of new technologies and disruptive business models has often raised significant privacy issues and exacerbated inequities, even when the technology has the potential to reduce inequity.

A key priority will be to ensure that both the Comptroller-led advisory entity and the ETAP take privacy and equity into account, and include a diverse set of perspectives.

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# Additional concepts under consideration

In the course of our research, several concepts emerged that we were not able to fully explore and incorporate into the main report. Nonetheless, we believe that these are areas that merit further investigation and serious discussion. We present them here to spark an ongoing conversation.

## Evaluating and regulating police technology

### The problem we face

In all of our discussions about privacy, the question of police technology in general—and surveillance in particular—came to the fore immediately. While our proposal on privacy in Chapter 1 addresses the question of interagency data sharing, and would cover the New York Police Department (NYPD), questions remain about how the department itself deploys technology in the course of its operations.

The NYPD has been a national and even global leader in using technology. Surveillance technologies, used with a warrant requirement, have been identified by some as a tool to address the rise of hate crimes and domestic terrorism.<sup>1</sup> NYPD's digital data-driven approach to tracking crime and deploying resources, CompStat, has long been heralded as a case study in the use of urban technology, and some have credited it with contributing to the drop in crime between the late 1990s and the late 2000s, although debate on that point is ongoing.<sup>2</sup> In the decades since CompStat's debut, the department has continued to aggressively build its digital surveillance infrastructure, and in the post-9/11 period, the NYPD has invested millions, if not billions, in surveillance technology to build its Domain Awareness System—a network of cameras, license plate readers, and other devices that monitor and record what is going on in public spaces across the city. Nor is surveillance machinery the only tech New York's police are interested in deploying; recently, NYPD demonstrated the use of a robotic dog in Manhattan, a move that led to a swift backlash and a withdrawal of the so-called “Digidog” from the streets.<sup>3</sup>

Many people we spoke to, and many reports and articles we read, however, question the NYPD's surveillance efforts, in terms of both their appropriateness and their efficacy. Some have raised concerns about CompStat itself.<sup>4</sup> Others cite NYPD's overreach with respect to surveillance and data, such as its monitoring of the City's Muslim community and the sharing of footage with IBM to train IBM's biometric recognition systems.<sup>5</sup> In 2020, NYPD monitored Black Lives Matter

protestors and tracked them down using facial recognition technology.<sup>6</sup> There have also been documented instances where the NYPD—either on an organizational level or through individual officers acting on their own—has skirted the need to obtain search warrants by using technology and private sources of data to obtain information that would otherwise require a warrant or goes against NYPD policy, such as the use of Stingray tracking devices and rogue use of Clearview AI facial-recognition technology.<sup>7</sup> The controversial “robot dog” deployment raised questions about the NYPD's ability to adopt new technology responsibly without oversight.<sup>8</sup> The fact that the data is gathered and used for law enforcement by the same entity means that there are few checks on a decision-making process that may be influenced by groupthink or a lack of diverse perspectives.<sup>9</sup>

While the City Council in 2020 passed the Public Oversight of Surveillance Technology Act (the “POST Act,” now Local Law 65 of 2020), even this law only requires the disclosure of technology used. Already, questions have been raised about the completeness with which the NYPD is providing the information required by the law.<sup>10</sup>

### Potential solutions

- Enhanced civilian oversight of NYPD's use of technology and surveillance, such as a new City Council committee granted access to sensitive data and holding secret hearings, following the model of the House and Senate Intelligence committees that oversee the federal government's intelligence operations
- Splitting NYPD's Surveillance Unit into a new, civilian-led NYC Department of Intelligence, which would share information with NYPD only under certain safeguards and protocols, following the model of the Central Intelligence Agency being separate from the U.S. Department of Defense
- Exploring and documenting the extent to which NYPD surveillance data has actually been useful in deterring crime or apprehending criminals

## Electronic payments

### The problem we face

The world is increasingly shifting to a digital payments economy. E-commerce's share of total retail sales in the United States has risen steadily over the last two decades, growing from 0.9% in 2000, to 4.4% in 2010, to 11% in 2019. The pandemic has only accelerated this trend, with e-commerce accounting for 14% of U.S. retail activity in 2020.<sup>11</sup> In other metrics, the Federal Reserve Bank of Atlanta reports that check payments have been declining at a rate of 7% per year over the last two decades, while card payments have been increasing at a rate of 8.9%. In 2018, debit cards surpassed cash as the most popular in-person payment type.<sup>12</sup>

Digital payment systems offer users a range of benefits, including efficiency and convenience. Meanwhile, the burdens of not being connected to the digital economy are growing—for example, the time cost of workarounds (e.g. having to go in person to pay a utility bill, not being able to pay the parking meter) as well as lack of access to goods when brick-and-mortar stores close.

Households without access to payment cards and/or access to the internet are excluded from the increasingly digitized economy. A recent report by the Federal Reserve Bank of Kansas City shows that 79% of people who are unbanked face digital and/or financial exclusion, and 11% of people who are underbanked and 13% of people who are fully banked face digital exclusion.<sup>13</sup>

While Chapter 2.1, Broadband, offers solutions to address digital exclusion for New Yorkers, the challenge of financial inclusion remains very difficult. As of 2017, an estimated 11.2% of New York households did not have a bank account (compared to 6.5% nationally), and 21.8% were underbanked (compared to 20% nationally). Many of these households are in neighborhoods with higher shares of Black, brown, and lower-income residents.<sup>14</sup> Digital commerce exclusion is worse for the very same households that are already struggling with economic security and mobility, and this exclusion exacerbates existing inequalities.

## Potential solutions

- Ensure that all New Yorkers have a bank account and debit card, either through partnerships with private banks or the creation of a public bank
- Convert public benefits payments to a single debit card, thus encouraging those unbanked New Yorkers who receive benefits to have a debit card
- Reinvigorate the NYC ID program to solve the problem of a lack of identification

## Package delivery

### The problem we face

Internet access is necessary but not sufficient for all New Yorkers to participate fully in the internet economy. E-commerce, despite its negative impacts on traffic congestion and local retailing, is without question a cornerstone of 21st-century life. The fact that so many New Yorkers rely on it for deliveries of household goods, groceries, meals, and other items suggests that ordering online offers real savings of both time and money.

However, many New Yorkers have difficulty accessing the benefits of the on-demand economy. The majority of New Yorkers live in multifamily buildings, and most of these do not have doormen or controlled package rooms. During the pandemic, reports of package theft from non-doorman buildings increased dramatically. It is certain that not all high-income New Yorkers live in doorman buildings, but it is true that most who live in doorman buildings are high-income. As a result, this problem disproportionately affects low-income New Yorkers, even though it is not confined to them.

While often portrayed as a luxury, delivery services may be highly relevant to the needs of low-income New Yorkers and those with disabilities or limited mobility. Internet-based sales offer a wide variety of choices, including some goods not available locally, often at lower prices than local retailers. The lack of secure access to delivery services thus threaten to recreate

the well-known problem of food deserts, which sees low-income New Yorkers paying higher prices for lower-quality food because their neighborhoods lack supermarkets. Further, the on-demand economy offers a partial solution to the phenomenon of time poverty, wherein low-income people lack the time to accomplish important personal tasks—such as helping children with homework and cooking healthy meals—because they are working long hours or multiple jobs.

## Potential solutions

- Offering sidewalk locations for delivery lockers, either owned by the delivery companies themselves or as shared facilities operated by third-party franchisees of the City
- Encouraging the development of a network of block-level delivery and return centers, either through the provision of City-owned property or direct subsidies
- Creating staffed package rooms at NYCHA facilities, either directly operated by NYCHA or outsourced to third-party vendors

## Electrifying buildings to reduce carbon emissions

### The problem we face

It is clear that the future of buildings requires a greater reliance on electricity. Reducing greenhouse gas emissions requires electrifying heating and cooling systems. Increasingly, it is clear that the use of gas for cooking inside homes is a contributor to poor indoor air quality. While many opportunities exist to convert buildings to rely more on electricity, an issue has emerged in our conversations that many residential buildings simply lack the electrical supply to accommodate a conversion of heating, cooling, and cooking. Upgrading these systems is often the key roadblock to both building-scale and apartment-scale improvements. Because this problem arises in older buildings, it also disproportionately affects low-income New Yorkers.

One challenge related to this that we have found is the simple fact that no data exists as to the extent of this problem.

## Potential solutions

- Conduct a survey of electrical infrastructure in NYC’s multifamily buildings to understand the extent of electrical upgrades necessary to underpin future technologies for energy efficiency and quality of life in residential buildings. Then, execute upgrades in tandem with broadband conduit upgrades under a “dig once” policy to minimize disruption to the streets
- Offer a major tax credit to buildings to upgrade their electrical systems in the context of a building upgrade and conversion away from fossil fuels
- Require that buildings pay for electrical upgrades whenever a tenant or unit owner wants to switch to electric-based cooking

## Illegal dumping

### The problem we face

Feedback from our interviews as well as concerns raised in Community Board hearings indicate that illegal dumping is a meaningful concern, particularly to residents of lower-density neighborhoods that are more prone to dumping. In 2021 alone, the City of New York Department of Sanitation (DSNY) received more than 20,000 requests for cleanup and enforcement of illegal dumping. Aside from the unsightliness and environmental impacts on residents near illegal dumping sites, cleanup poses a direct physical threat to sanitation workers because of the presence of loose broken glass, used needles, sharp metals and dangerous liquids.

Currently, to combat illegal dumping, DSNY imposes fines starting at \$4,000 for anyone caught illegally dumping from a vehicle and impounds the vehicle. DSNY also tracks down individuals using mailing addresses, for instance, and fines them a lesser sum for improper disposal.

DSNY can use imagery from cameras to enforce illegal dumping. Currently, this effort requires independent cameras, as the department does not have access to NYPD's cameras to identify vehicles from which illegal dumping has taken place for enforcement. However, DSNY has identified an opportunity to integrate images from NYPD cameras into their enforcement program.<sup>15</sup> DSNY is making attempts to crack down on illegal dumping by conducting anti-rubbish blitzes and partnering with local elected officials to install cameras in strategic locations for additional monitoring.<sup>16</sup> While these measures are helpful, there should be a proactive approach to dealing with illegal dumping rather than reactive.

## Potential solutions

- DSNY should work either with the NYPD or DOT to train their cameras to recognize illegal dumping using computer vision and AI. Under the privacy concepts proposed in Chapter 1.1, Privacy, such a use would require the approval of Commission on Public Information and Communication or any other equivalent body that is required to review new uses of technology and interdepartmental cooperation using data that might have privacy implications. In cases where purchase of new cameras is necessary, DSNY should take active steps to address any affordability issues, particularly for resource-constrained neighborhoods.

## Government accountability

### The problem we face

The Mayor's Management Report (MMR) is a document that presents statistics on the performance of each city agency across a number of indicators. Inaugurated in 1979 by Mayor Ed Koch, it is now mandated by the City Charter.<sup>17</sup> Issued twice each year, the paper report runs to hundreds of pages. It is now also available through a web interface.

Despite the MMR's history and charter mandate, our research suggests that the MMR is now obsolete. Many agencies offer more comprehensive and timely data, tracking even more important indicators than those followed in the MMR. Further, the success of the open-data movement, in which New York City was a leader, means that extensive data sets are updated regularly, allowing those with the interest and skills to understand the performance of City agencies in a far more detailed and often more useful way than the MMR permits. At the same time, some observers are frustrated that City agencies publish data but do not recognize the implications of the data they publish as it pertains to their operations.

## Potential solutions

- Sunset the MMR and replace it with a comprehensive, continuously updated dashboard driven by the data sets available on NYC Open Data

## Multichannel interaction with the City

### The problem we face

In many respects, 311 and nyc.gov have been tremendous successes: in 2020, the City's 311 hotline received 23.5 million calls—an average of roughly 3 calls for every New Yorker.<sup>18</sup> Each month, 5.4 million unique visitors used nyc.gov.<sup>19</sup> In addition, 311 has undergone significant improvements since it was established in 2003, and now offers user accounts, web- and phone-based interactions, a mobile app, and transparent tracking of complaints and requests; it is slated for yet further improvements.<sup>20</sup> Many agencies have invested significantly in digitizing permitting and application processes. In addition, the City's Public Engagement Unit (PEU), founded in 2015, uses technology and community-organizing techniques to seek out New Yorkers who may be in need of City services or programs but have not requested them.<sup>21</sup> The PEU complements the many self-service channels that research demonstrates are more likely to be used by those who are already aware of their rights and

how the government works.<sup>22</sup> If all these initiatives are considered, New York City has done an admirable job of creating multiple channels through which to engage with residents.

At the same time, our research indicates that the City's overall approach to interacting with residents remains fragmented and obsolete compared to the level of service that New Yorkers are accustomed to from private entities such as banks, airlines, or insurance companies. While 311 and nyc.gov can direct you to every City agency, your 311 login does not get you into your Department of Finance account. Checking on your property-tax bill does not lead to a reminder about when your water bill is due. An application for food stamps does not automatically identify the other services that might be relevant to you. In addition, it is not clear to which City entity you should direct any given complaint or concern. Who deals with a hazardous patch of sand in a bike lane? Who should you call if you are concerned about someone in a mental-health crisis?

The result is a fragmented experience for New York residents. A recent report from Columbia University pointed out that “too many competing platforms across multiple agencies” produce “a crisis of attention,” in which residents are “expected to become conversant with multiple platforms and tools” in order to obtain what they need. This, the summary report concludes, creates “an excessive burden on residents.”<sup>23</sup>

## Potential solutions:

- Reinvent 311 and nyc.gov entirely, replacing them with a unified multichannel constituent service system based on service design principles
- Replace currently separate agency systems with a single, new, presumably cloud-based database
- Create a central login that would unlock all of an individual's accounts with various City agencies, while allowing those accounts to remain separate

## Digitizing democracy

### The problem we face

Nyc.gov and 311 generally address residents as consumers, not as constituents. The City Council has attempted to use technology to improve democracy, through its early embrace of participatory budgeting (PB), which has been shown to engage residents and to shift budget priorities. But PB has been held back by a number of constraints. First, the only funds appropriated through PB have been the small amounts (\$1 million) allocated to Councilmembers for their own discretionary district projects. Second, managing the PB process has been a burden placed on the Councilmembers' staff.<sup>24</sup> Voters have indicated an interest in PB, however, overwhelmingly passing a 2018 amendment to the City Charter establishing a Civic Engagement Commission (CEC), whose main mission is to implement a citywide participatory budgeting program.<sup>25</sup>

Cities around the world have been far more aggressive in using technology to widen democracy. Decidim, an open-source platform originally developed by the City of Barcelona and now supported by peer cities around the world,<sup>26</sup> including municipalities in France, Japan, and Finland, is a platform that directly connects residents with the tools of government, such as collaborative tools for drafting proposals and support for running participatory-budgeting processes. It also enables a variety of modes of participatory democracy, such as lottery-driven citizen juries that promote equitable representation of the public.<sup>27</sup> In Barcelona, Decidim has allowed citizens to submit proposals into the city's Municipal Action Plan; 7.5% of the population participated directly in submitting or commenting on those proposals, and nearly 15% of the public's ideas were accepted into the City's budget.<sup>28</sup> While 7.5% seems like a small proportion of the overall population, by comparison only 6% of New Yorkers voted in the Democratic mayoral primary in 2017.<sup>29</sup> The CEC has committed to setting up a local instance of the Decidim tool, although to date its activities have been limited to a small, citywide PB experiment focused on youth.<sup>30</sup>

Overall, a problem that our research identified is that PB is currently subscale, and the restrictions on its funding prevent it from addressing many citizens' primary concerns.<sup>31</sup>

## Potential solutions

- Expand Participatory Budgeting to encompass significant amounts of money, including operating funds
- Use the CEC's Decidim tool to consult with the public before major City Council votes on legislation
- Use Decidim to augment Community Boards as a way to poll local residents
- Use Decidim's "citizen juries" to provide input to major City decisions

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# The team

This project was initiated and led by Rohit T. Aggarwala. Michael E. Bloomberg led the work on broadband access and administration, and assisted with overall project management. Victoria M. Woo led our work on privacy. Rebecca Lassman led our work on social service delivery. Adrian J. Silver led our work on drone facade inspections and automated code enforcement. Philip D. Ellison and Matt Stempeck worked together on issues related to civic engagement. Conor Lyman led the work on battery energy storage. Preksha Agarwal led our work on solid waste management. Andrew Salzberg led our work on digital mobility. Linda Jaber was the project manager and designed an outreach effort for the second phase of research, as well as contributing to the broadband chapter. Sarah Goodyear edited the final draft of the report. Ben Oldenburg managed all graphics, illustrations, and layout. The project was sponsored by the Urban Tech Hub under the leadership of Founding Director Michael M. Samuelian.

## Rohit T. Aggarwala



Rohit T. “Rit” Aggarwala is a Senior Fellow at the Urban Tech Hub at the Jacobs Cornell-Technion Institute at Cornell Tech. He is also an executive-in-residence at Closed Loop Partners, an investment firm focused on the circular economy. He teaches urban policy at Columbia University, and recently chaired the Regional Plan Association’s Fourth Regional Plan for the New York metropolitan area.

Rit was a member of the founding team at Sidewalk Labs, where he was Head of Urban Systems and led its mobility and sustainability work. Prior to that, Rit spent five years at Bloomberg Philanthropies, where he started the foundation’s environmental grantmaking program, served as President of the Board of the C40 Cities Climate Leadership Group, and led the sustainability practice at Bloomberg Associates.

From 2006 to 2010, Rit served as Director of New York City’s Office of Long-Term Planning and Sustainability where he led the creation and implementation of *PlaNYC: A Greener, Greater New York*. *PlaNYC* has been hailed as one of the world’s best urban sustainability plans, leading New York City to a 19% reduction in its carbon footprint during the Bloomberg Administration. Prior to joining City Hall, he was a management consultant at McKinsey & Company and served at the US Department of Transportation.

Rit holds a BA, MBA, and PhD from Columbia University, and an MA from Queen’s University in Ontario. He serves on the boards of the Regional Plan Association, the Urban Green Council, and the Design Trust for Public Space, and is a trustee of St. Stephen’s School in Rome, Italy. He was born in New York City, where he now lives.

## Michael E. Bloomberg



Mike Bloomberg is the Urban Technology Researcher for the Jacobs Technion-Cornell Institute at Cornell Tech. Mike’s research focus is on the overlap of digital, physical, and social infrastructure in building more equitable and resilient communities. In addition to his work for Cornell Tech, Mike is the Director of Groundwork Data, a nonprofit infrastructure research initiative to improve public infrastructure. He previously served as Chief of Staff and Technology Director to the Mayor of Holyoke, Massachusetts and is a 2018 graduate of the Johnson Cornell Tech MBA program at Cornell Tech.

## Victoria M. Woo



Victoria Woo is pursuing a Masters in Laws in Law, Technology, and Entrepreneurship at Cornell Law School and Cornell Tech. She holds dual law degrees—a Juris Doctor and a Bachelor of Civil Law—from McGill’s Faculty of Law. Previously, she was at the Toronto office of a leading global law firm working on intellectual property, privacy, and corporate matters.

## Rebecca Lassman



Rebecca Lassman is pursuing a dual Masters in Applied Information Science and Information Systems with a concentration in Urban Tech at the Jacobs Technion-Cornell Institute at Cornell Tech. She is passionate about creating more just, livable, and sustainable cities through the thoughtful application of data and technology. Previously Rebecca was a senior analyst at HR&A Advisors, Inc. where she supported public, private and nonprofit clients focused on creating long-term economic opportunity for communities and cities around the world.

## Adrian Silver



Adrian is Head of Business Development at CodeGreen Solutions, a leading national real estate sustainability consulting firm. Previously, Adrian worked at Carbon Lighthouse, where he initiated energy efficiency retrofits across the United States equivalent to multiple power plants of emissions.

Adrian is also an adjunct assistant professor in the Real Estate Development program at Columbia University's Graduate School of Architecture, Planning, and Preservation, where he teaches a course on sustainability in commercial buildings. He serves on the board of directors for Community Impact, Columbia University's largest community service organization. Adrian holds a BA in Urban Studies from Columbia University.

## Phillip D. Ellison



Phillip is the Manhattan Borough Advocate and liaison to the Technology, Data, & Development team at the Office of the NYC Public Advocate. He is also the inaugural Civic Innovation Fellow at the Digital Life Initiative research lab at Cornell Tech. Before that, Phillip was a nontraditional student at Tufts University and an honors student at Hostos Community College. At Tufts, he was awarded the Presidential Award for Citizenship & Public Service. He is passionate about leveraging the intersections of community and government affairs, data and technology, design thinking, and entrepreneurship to explore new markets, and also about empowering underserved communities to solve the problems they face.

During a hiatus from his undergraduate studies and afterward, he served as an AmeriCorps member with City Year, worked at Citizen Schools, and gained extensive experience in both local and national political campaigns including Obama For America. In Boston, Phillip launched ULink, an education enterprise software startup supporting community college students in proactively managing the transfer process and improving student engagement on campus.

In 2016, The Millennial Trains Project selected Phillip to be a City Year-Comcast NBCUniversal Fellow to travel 3,000 miles across the United States to five cities with millennial public artists, entrepreneurs, social innovators, and international Fulbright researchers. He serves as a U.S. Advisor to the Global Black Youth Project and as an Entrepreneurship Coach at the Tufts University Entrepreneurship Center.

## Matt Stempeck



Matt Stempeck is Technologist in Residence at Cornell Tech, where he's helping develop the Public Interest Tech Impact Fellowship. Matt also curates the *Civic Tech Field Guide*, a crowdsourced collection of over 4,000 tech-for-good projects, and builds engagement technology at the Bad Idea Factory for clients like STAT News.

Before joining Cornell University, Stempeck was the Director of Civic Technology at Microsoft in New York City. He led the Digital Mobilization team at Hillary for America in 2016, which leveraged peer messaging, social media, SMS, and digital phonebanking tech to help millions of Americans vote.

Stempeck holds a Master's of Science from the MIT Media Lab's Center for Civic Media and a Bachelor of Arts, High Honors, from the University of Maryland College Park. He serves on several advisory boards for civic tech organizations and regularly contributes to impact research on the use of emerging tech for the public good.

## Conor Lyman

Conor Lyman is a first-year graduate student in the Jacobs Technion-Cornell Institute studying Urban Technology. He received a Bachelor of Science degree in mechanical engineering from the George Washington University in 2017. Prior to coming to Cornell Tech, Conor worked for Blueprint Power, a New York City-based company working to transform the built environment into a flexible, carbon-free power network. He most recently managed their energy modeling and simulation team, and continues to consult for the company.



created and held a unique executive role at Uber, where he built the first teams focused on partnerships with public transportation agencies and environmental sustainability. Prior to joining Uber, Salzberg worked at the World Bank on urban and transport development in China. He holds a Bachelor of Civil Engineering from McGill University, and a Master's in Urban Planning from Harvard.

## Preksha Agarwal

Preksha Agarwal is pursuing a dual Masters in Applied Information Science and Information Systems with a concentration in Urban Tech at the Jacobs Technion-Cornell Institute at Cornell Tech. She is passionate about creating more equitable and sustainable urban systems through data-driven technology and inclusive innovation. Previously, Preksha was a Senior Data Engineer at Tresata Inc., where she worked closely with her clients in the banking industry to solve problems associated with customer intelligence, regulatory reporting, risk, and ESG analysis.



## Linda Jaber

Linda was the project manager for *Rebooting NYC* where she designed an outreach program to collect input from the different constituents of the City regarding the recommendations published in the report. Previously, she was a housing policy research and analysis intern at the NYC Department of Housing Preservation and Development, where she worked on the COVID-19 data analysis for the *Where We Live NYC Plan*.



Linda started her career as an Architect back in her hometown of Beirut. She holds a Masters in Applied Urban Science & Informatics from New York University and a Bachelors in Architectural Engineering. Her interests fall at the intersection of cities, design, and data, and she has a strong commitment to deploying her skills for the benefit of her community.

## Andrew Salzberg

Andrew Salzberg is an independent climate technology consultant and lecturer at MIT, where he created the Decarbonizing Urban Mobility course. He also serves as a strategic advisor to leading mobility and climate technology companies, including Transit App, ClimateView, and Populus. Finally, through OpenNorth, a non profit advisory service, he advises municipalities across Canada on technology deployment.



From 2019 to 2020, Andrew was a Loeb fellow at Harvard, where he started the Decarbonizing Transportation newsletter. Before the Loeb fellowship, he

## Sarah Goodyear

Sarah Goodyear is a journalist specializing in urban affairs. Her work has appeared in *CityLab*, *The New York Daily News*, *The Village Voice*, *Ms. Magazine*, *Psychology Today*, and many other venues. She most recently is cofounder and cohost of *The War on Cars*, a podcast that looks at the effects of automobile dependence on our society and the environment. She is also the author of a novel, *View from a Burning Bridge*, published by Red Hen Press. Sarah has a Bachelor's in Film Theory from the University of California, Berkeley, and is pursuing a Master's in Biography and Memoir at the Graduate Center of the City University of New York.



## Michael M. Samuelian



Michael Samuelian the Founding Director of the Cornell Tech Urban Tech Hub. He is an urban planner, real estate developer, professor and most recently the President and CEO of the Trust for Governors Island. From the revitalization of Lower Manhattan after 9/11 to the creation of a new neighborhood in Hudson Yards and the activation of Governors Island, he has helped plan, design, and develop some of the most transformative projects in New York City.

Prior to his appointment as President of the Trust, Michael was a Vice President with Related Companies, where he was responsible for the planning and design of Hudson Yards. After 9/11, Michael was the Director of Lower Manhattan Special Projects at the New York City Department of City Planning, helping the city's efforts to redevelop downtown.

He received a Master of Architecture in Urban Design from Harvard University and a Bachelor of Architecture from Cooper Union. Michael is currently an Assistant Professor at Cooper Union, where he teaches Professional Practice in the School of Architecture. In 2018 Michael was the Bass Distinguished Fellow at the Yale School of Architecture, he is also a frequent lecturer at Harvard Law School and NYU Schack Institute. Michael holds concurrent academic appointments at both Harvard and Yale in the spring of 2020. At Yale he teaches a new seminar on the history, planning, and design of Hudson Yards, while at Harvard he leads an urban design studio focused on the former Amazon site in Long Island City.

Michael is a Fellow of the AIA and Chair of the New York State Board for Architecture.

## Ben Oldenburg



Ben Oldenburg is New York-based information designer focusing on graphic design, data visualization, and illustration around urban planning and transportation. Ben previously worked as the senior graphic designer

for Regional Plan Association producing a wide range of visual content to support research, development, and advocacy efforts. He holds a BA in Visual Arts from Fordham University.

## Conflict of interest disclosures

Rohit T. Aggarwala has in the past been a paid consultant to Closed Loop Partners, which holds an interest in HomeBiogas, a company mentioned in this report. He was involved in establishing Coord while at Sidewalk Labs. He has no current financial interest in Closed Loop, HomeBiogas, Coord, or Sidewalk Labs.

# Acknowledgments

During the course of this project, we interviewed many New Yorkers (and a few out-of-towners) for their expertise and opinions.

Our approach has been to treat all interviews under the Chatham House Rule, in which we can use information offered to us but we do not attribute information to specific interviews. We have made only a few adjustments to that approach, and only at the specific request of the interviewees.

We are grateful to those listed here for their time and effort, as well as to several who preferred to remain anonymous. Many of the facts, ideas, and perspectives in this report reflect their input, but of course the responsibility for any errors of fact or interpretation rests with the authors alone.

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# Summary of recommendations

Recommendations	Rationale	Initiatives	Responsibility
<b>1. Foundations: Privacy and administration</b>			
<b>1.1 Enact a law regulating how City agencies and private entities gather and share data from the public realm</b>	<i>Because City agencies have significant leeway in how they use data collected in the public realm, many New Yorkers are concerned that more data-gathering will lead to violations of privacy</i>	Enact rules that govern how City agencies use and share data, with the objective of facilitating data use and sharing that conforms to the principles of contextual integrity	City Council
		Establish an oversight process for agencies that seek to deploy new data-gathering capabilities or combine datasets in new ways	City Council, Public Advocate
		Enact transparency requirements for how private entities gather, share, and use data collected in the public realm, and limits on how they may use or sell data collected without consent	City Council
<b>1.2 Make the City an effective purchaser, developer, and manager of technology projects</b>	<i>The City is not as well organized or staffed as it should be to purchase and manage technology well</i>	Appoint a Deputy Mayor of Technology to manage all of the City's technology systems and policies, while focusing DoITT on the core task of providing the City's IT systems	Mayor, City Council
		Have the New York City Comptroller conduct a regular broad inventory and audit of the City's technology infrastructure and investments	Mayor, Comptroller
		Create a New York City Digital Service to inject new technology talent into City government	Mayor, City Council
		Use these additional staff to shift to a co-development model of working with vendors	Mayor
<b>2. Technology equity: Include everyone in the digital economy</b>			
<b>2.1 Create a Broadband Development Corporation to bring the internet to all New Yorkers</b>	<i>Too many New Yorkers lack access to broadband internet</i>	Establish a Broadband Development Corporation tasked with the creation of a citywide open-access fiber network and utility corridor network	Mayor, City Council
		Assert a City role in ensuring building access	Mayor, City Council
		Ensure the BDC can coordinate the activities of other city agencies	Mayor
		Ensure that Empire City Subway is executing its franchise in the best interests of the City	Comptroller, Mayor
		Institute two approaches to gather data on broadband access: annual reporting from building owners, and inclusion of broadband questions in the Housing and Vacancy Survey	City Council, Mayor
Use the Public Engagement Unit to address digital inclusion in a strategic, data-based way	Mayor		



### 3. Optimized systems: Use technology to improve the management of our built environment

<b>3.1 Bring safety and order to our streets through digital management and enforcement</b>	<i>Our streets and curbs are too dangerous and disorderly because traditional management and enforcement practices are ineffective</i>	Build out a complete network of enforcement cameras immediately, and use them to the fullest extent of City authority	Mayor
		Obtain State legislative authority to use technology to enforce all traffic violations	Mayor, City Council
		Explore ways to ensure that low-income violators are not unduly burdened by fines	Mayor
		Ensure that camera-enforcement systems operate fairly and transparently	Mayor (DOT)
		Implement a curbside management system allowing parking reservations	Mayor, City Council
		Explore requiring speed limiters on TLC-licensed vehicles	Mayor (TLC)
<b>3.2 Convert and expand bike lanes into a network that accommodates a variety of new mobility vehicles</b>	<i>Many new urban-friendly vehicle technologies are emerging, but these have no place to travel on NYC streets</i>	Redesign NYC bike lanes to be wider New Mobility Lanes, and build out the network	Mayor (DOT)
		Obtain State legislation allowing New York City to determine what vehicles are allowed in the New Mobility Lanes	Mayor, City Council
		Establish vehicle standards for use of the New Mobility Lanes	Mayor (DOT)
		Institute comprehensive enforcement for New Mobility Lanes	Mayor (DOT)
<b>3.3 Require mobility companies to offer transparent, real-time pricing and payment options</b>	<i>New Yorkers rely on taxi and for-hire vehicles more than people do anywhere else in the United States, but there is currently no way for them to know if they are getting the best price for the trips they need to take</i>	Require open data feeds and payment APIs for taxi and ride-hail operators	Mayor (TLC)
		Require open payment APIs for bike share and shared scooter systems	Mayor (DOT)
		Require open-payment APIs for public transportation systems, starting with the NYC Ferry	Mayor (EDC)
<b>3.4 Propel New York City's design and construction industry into the digital age by moving to automated code review</b>	<i>NYC's design and construction industry does not use technology as much as it could, and too few permit applications are reviewed in detail by the City</i>	Enact into law a date certain by which all permit applications will need to be submitted in a new standard BIM format	Mayor (DOB), City Council
		Launch a working group to develop a set of universal standards and application programming interfaces (APIs) for BIM files that DOB will accept	Mayor (DOB)
		Begin to translate New York City's codes from legal text into computable, machine-readable logic	Mayor (DOB)
		Start an effort to train the entire AEC industry on BIM	Mayor (DOB)
<b>3.5 Reduce the number of sidewalk sheds by thoroughly testing how drones can evaluate the safety of building facades</b>	<i>Drones have the potential to conduct facade inspections and thus reduce the prevalence of sidewalk sheds, but evaluating their potential fully will require a rigorous evaluation including the consideration of new approaches to meeting inspection requirements</i>	Issue a Request for Information to see what the private sector proposes as a drone-based solution to facade inspection requirements	Mayor (DOB)
		Conduct a thorough side-by-side test of human and drone-based inspections using a sizable sample of buildings up for facade inspection in 2023	Mayor (DOB)
		Based on the results, incorporate these results into a revised approach to facade inspection starting in 2025	Mayor (DOB), City Council

Recommendations	Rationale	Initiatives	Responsibility
<b>3.6 Improve sanitation efficiency by upgrading waste management technology</b>	<i>NYC's waste technology has fundamentally not evolved since the 1970s, and that has led to unsightly streets and sidewalks, vermin infestations, environmental pollution, and unsafe conditions for sanitation workers</i>	Establish a long-term goal for the City for on-site anaerobic digestion	Mayor (DSNY)
		Develop a plan for citywide containerization of waste and semi-automated collection	Mayor (DSNY)
		Initiate the process to integrate sensors in containers to enable dynamic routing	Mayor (DSNY)
		Fully explore technology as part of the planning for the new Solid Waste Management Plan	Mayor (DSNY)
<b>3.7 Accelerate renewable energy adoption in the City by promoting battery energy storage</b>	<i>Aggressive climate goals at the City and State level - include goals specifically for energy storage - combined with an updated fire code to permit indoor battery storage will transform the City's electric grid and accelerate the transition to a cleaner, more equitable grid</i>	Develop a streamlined permitting and approval process for storage	Mayor (FDNY, DOB)
		Undertake an aggressive effort to encourage battery storage projects where they are needed most	Mayor
		Fully integrate battery storage into the City-led building decarbonization programs and policies	Mayor

### Always open: Make it easier to engage with the City

<b>4.1 Make it easier for New Yorkers to obtain social services through the creation of a data locker and interagency verifications</b>	<i>Applying for benefits is difficult, and requires significant documentation that is often already held by a different City agency</i>	Create secure and easy-to-use personal data lockers to store eligibility-related documentation	Mayor
		Streamline benefits applications across City agencies, beginning with the user interface of online applications	Mayor
		Add a feature to ACCESS NYC that allows New Yorkers to keep track of their City programs and when they need to reapply	Mayor
<b>4.2 Make Community Boards more representative by holding hybrid and virtual meetings, using digital tools to broaden their reach and expand access</b>	<i>In-person Community Board meetings are often unrepresentative because meetings are difficult to attend in person; technology offers ways to broaden participation and accessibility</i>	Advocate for Albany to amend the Open Meetings Law to allow continued virtual and hybrid public meetings after the pandemic	Mayor, City Council
		Provide Community Boards with user-friendly, standardized webcasting kits	Mayor, Borough Presidents
		Use 2022 as an experimental period in which to iterate and refine best practices	Mayor, Borough Presidents
		Upgrade meetings with automatic transcriptions, captions, and translation to improve accessibility	Mayor, Borough Presidents
		Create an interest-based alerts service for New Yorkers	Mayor, Borough Presidents
Facilitate and broaden opportunities for community input	Mayor, Borough Presidents		

Recommendations	Rationale	Initiatives	Responsibility
<b>Futureproofing: Position NYC to shape the urban technology of the future</b>			
<b>5.1 Develop rules that shape and encourage emerging technologies in advance of their arrival</b>	<i>New technology and tech-driven business models have often caught New York City without an effective regulatory regime that can both protect the public's interest while also encouraging fast adoption</i>	Commission one or more external entities to lead a fast process to make regulatory proposals for new technologies that are already entering use in New York City or elsewhere	Mayor
		Create a permanent, independent Emerging Technology Advisory Panel to issue biennial reports to the City on emerging technologies and their implications	City Council

Recommendations	Rationale
<b>Additional concepts under consideration</b>	
<b>Evaluating and regulating police technology</b>	<i>Many New Yorkers are concerned that NYPD's surveillance technology has evolved without sufficient oversight</i>
<b>Electronic payments</b>	<i>Too many New Yorkers do not have a bank account and thus cannot participate in online transactions</i>
<b>Package delivery</b>	<i>Too many New Yorkers have difficulty receiving deliveries</i>
<b>Electrifying buildings to reduce carbon emissions</b>	<i>New technologies will make NYC's buildings greener, but many buildings do not have the electrical capacity to accommodate new equipment</i>
<b>Illegal dumping</b>	<i>Illegal dumping poses an environmental threat to the residents of certain neighborhoods, as well as physical a threat to sanitation workers</i>
<b>Government accountability</b>	<i>The Mayor's Management Report could be updated to make use of new forms of data</i>
<b>Multichannel interaction with the City</b>	<i>311 and nyc.gov could be updated and integrated</i>
<b>Digitizing democracy</b>	<i>Technology should broaden democratic participation</i>

