Rebooting NYC
An Urban Tech Agenda for the Next Administration

Draft for Discussion

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URBAN TECH HUB

About the Urban Tech Hub

The Urban Tech Hub of the Jacobs Technion-Cornell Institute at Cornell Tech is a new venture 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 that 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 by the Jacobs Institute's Urban Tech Hub at Cornell Tech

Drones inspecting building facades, a digital wallet for public benefits, affordable broad-band for all and fewer trucks and cars on city streets thanks to new mobility options. These are not sci-fi dreams, but a reality that can be brought to New York City within the next administration using existing technologies.

The Urban Tech Agenda for NYC is an applied research initiative dedicated to proactively 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 there are significant institutional barriers to adoption of new technologies in city government. It is our hope that the next Mayoral administration will take on this agenda to both improve the performance of urban systems and the quality of life for all New Yorkers.

While the COVID-19 pandemic exposed deep existing social, economic and racial inequi-ties in the city, it also accelerated the adoption of new technologies in unexpected ways. This report is the product of over 100 interviews with tech and civic leaders, current and former government officials, and everyday New Yorkers, that focused on the challenges that technology can address in improving both the performance of urban systems and social equity in the city. This is not intended to be a comprehensive plan just yet, but an inspirational guide to the possibilities that new urban technologies can provide. The specific recommendations range in scale and scope from the management and procure-ment of urban systems to the deployment of artificial intelligence to aid city workers and better protect and serve the public.

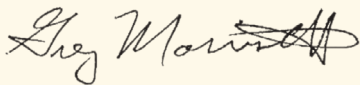There are five main areas of focus for this report;

1. Lay the groundwork by protecting privacy and ensuring the City can implement technology well

2. Ensure all New Yorkers can participate in the digital economy

3. Optimize urban systems with new, but widely available and trusted technologies

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 issues are necessary foundations that are required in order to effectuate the useful expansion of urban technology tools and products more widely across the city. It is impossible to discuss expanding the utility of new technologies if people do not have access to the technology in the first place. We believe high-speed broadband is akin to a public utility, and just as we take it as a public mission to deliver clean water to every New Yorker, so should we deliver high-speed internet service. 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. Just as public safety is a central mission of local government, digital safety must be ensured by government.

The barriers to the adoption of new technologies are many, but so are the opportunities to improve the flow of traffic, the provision of public benefits and the overall quality of life in the City.

Finally, this report is being issued as a draft, intended to provoke productive debates and discussions amongst the multitude of stakeholders that make up our diverse city. It is our ultimate goal that these proposals serve as a guide for the next administration to embrace new urban technologies in order to help make New York stronger, fairer and more resilient.

We look forward to your comments.

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Introduction

The 2021 municipal elections come at a pivotal moment for New York City. The next Mayor, Comptroller, City Council, and elected officials will need to lead the City's recovery from the COVID-19 pandemic. These newly elected officials will also inherit urban challenges that existed long before the pandemic, many of which have worsened over the past year; from racial inequality and struggling small businesses, to a growing mental health crisis and police reform. New York's struggles are not unique to New York, but felt 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 for our nation.

The widespread use of digital technology has helped solve many challenges faced by New Yorkers, but these new technologies have too often been accompanied by devastating side effects. While platforms like Amazon and GrubHub have helped many city residents reduce their exposure to the coronavirus pandemic by offering online shopping and delivery services, the increased toll it has taken on the workers and small businesses who make those services possible has caused a new set of challenges for the city. Ride-hail companies like Uber and Lyft along with mobility services such as Citibike and Revel have changed the very way we use our streets. New technologies on the horizon—drones, autonomous vehicles, robots—promise that these tech-driven changes 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, culminating in the creation of Cornell Tech on Roosevelt Island. The de Blasio Administration has made great strides in centering the role of design, equity, privacy, security, and citizen engagement in the City's technology strategy. Yet as far as the City has come in the past 20 years, there is still much to improve when it comes to the City's 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 for this agenda to offer a set of well-considered ideas that the public, candidates, and eventual elected officials can implement.

Our objectives

The purpose of this *Agenda* is to lay out a set of uses of technology that can be undertaken by New York City's next government to address issues that are of direct importance to a broad range of New Yorkers. Some proposals have a greater impact indirectly than directly, but our intent has been to find opportunities where existing technology can not just improve governmental processes, but directly improve the daily experience of city residents.

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

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 to meet the constraints of what can be accomplished in a four-year term of office. We have 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.[1] 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.[2] We wholeheartedly endorse both of these efforts and recommend that each candidate and eventual nominee 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 topics where municipal government has direct control, even if, in some cases, it still requires permission from Albany. As a result, we have not focused on technology as it relates to the subways, for example, as that is clearly important to New Yorkers but is not subject to real influence by the mayor or any other municipal official. At some point, a similar effort might be worth undertaking to look at New York State.

Our initial findings

Our work to date has led us to the conclusion that 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. The first of these is that many New Yorkers are hesitant to support the greater use of urban technology because we do not have a comprehensive, credible law governing the use of data collected in the public realm. The second is that the city's government agencies are right now not fully up to the task of implementing many large-scale technology projects simultaneously; this speaks not to the failures of the many talented individuals in the City, but rather compliments them for getting so much done under the constraints of what we find to be a poor organizational structure and an inability to hire the number of technology experts the City really needs. Finally, New York will never embrace technology fully when it is clear that a large portion of New Yorkers are left out of the digital economy. These three challenges form a prerequisite to the technology-enhanced city.

If we can surmount those challenges, there are many ways that technology can improve the lives of New Yorkers. In this draft document, we recommend ways to use technology to bring safety and order to our streets; to make it easier for New Yorkers to apply for benefits and services; to reduce the number of sidewalk sheds obstructing our paths; to improve access to Community Board meetings. We chart a path to making New York City a place where novel, low-speed vehicles carry a

"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."

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 reduced time to construction. We suggest a way for New York City to go from being in a series of wars with the companies behind disruptive technologies to setting rules and then welcoming those companies that play by those rules. Each of these individually is an incremental improvement; taken together, we believe that these would transform the experience of living in this city dramatically over four years.

A Draft for Discussion

Given the constraints imposed by the breadth of the topic and the size of our research team, there are many important areas where technology can play a supporting role that we did not get to evaluate in this draft. This includes critical areas such as: public health, sanitation, waste, and recycling, policing and security (outside of privacy issues), and public education. We omit these not because they are unimportant, but because they are important enough to merit a deeper focus.

In developing this draft we have relied on extensive interviews, independent research, and our collective experience. The bulk of our interviews were former government officials, technology providers, advocates, and academics, but the bulk of our recommendations require additional voices and deeper engagement. Our plan for the next phase of this work is to use the next several months to meet with a wide variety of individ-

uals and organizations to share what we have found, discuss our recommendations, and to receive feedback and input from the broader New York City community.

We also welcome initial questions and feedback which can be shared through our website.

Questions for discussion

At the end of every proposal and concept, there is a list of questions for discussion. These are the questions that we are wondering about as it relates to the work we have done thus far. We offer these genuinely; we have spoken to more than 120 people in the course of this work, but that is far from an exhaustive list, and we are sure that we have made errors both of fact and interpretation. In addition to these topic-specific questions, we conclude this introduction with the questions that we hope you will consider as you review the document. And we hope you will share your answers with us. These are:

- Are we focused on the right things? Are the problems we identify real? Do they resonate with New Yorkers? Are there problems that have technology solutions that we have overlooked?

- Have we gotten our facts right? Have we misinterpreted key findings?

- How practical are our ideas? Are there roadblocks or fatal flaws that will make our ideas infeasible?

- Have we missed any unintentional negative consequences of our proposals? Do any of these proposals run the risk of doing more harm than good?

- How worthwhile are these? Do the justify the expenditure of public money, political capital, and bureaucratic effort?

- Finally, what have we missed? Are there important problems, solutions, stakeholders, or innovators that should be considered for inclusion in the conversations to follow this report?

We welcome your questions and feedback

Visit: cornelltech.io/RebootingNYC

References

1   http://nycroadmap.us
2   https://civictech.guide

1 Foundations: Privacy and administration

New urban technologies offer extraordinary opportunities for New York City, from safer streets to easier social services access 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 led to potentially helpful technologies such as sensors and cameras being resisted, for legitimate reasons. 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, and 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 the foundations, 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 to 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 how 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 residents' interactions and the practices of businesses are safe, where garbage needs to be picked up, who needs help, 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. Generally speaking, 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 is 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 who is registered to vote, and which political party they belong to, 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 financial transactions as confidential, yet we also know that the City publishes the purchase price of every homeowner's property in a searchable database.[1]

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. In the context of the City's need to determine how much we owe in taxes, we understand that it needs to know our income; that is not a privacy violation. But we do not give the City the right to make that information public, or sell it to a marketing company, or even to use it to determine where our children can go to school. We accept that the City needs

to ensure that our elections are legitimate, and that transparency is the best way to do so: this means that we accept that our voter registration information, and even the information on whether we voted in a given election, is going to be published. We know that if a crime is committed, having insight about who was going in and out of a building can allow the police to capture the perpetrator, and can also help exonerate suspects who were not there at the time. In those cases, we are generally comforted by the presence of a closed-circuit TV (CCTV) camera. 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.[2]

> **"** What is private, however, is not clear-cut; in fact, our expectations for how we share information with the City is full of contradictions."

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.

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.[3] Prior to the digital age—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 goes unnoticed. This helped ensure that contextual integrity was difficult to violate, simply because it took a lot of work to do so.

Today, however, your cell phone tracks your location, your social media posts and searches reveal your interests and connections—and all of this data is easy to aggregate, store, and analyze for purposes that may not have been obvious. In the aftermath of the pandemic, for example, we know that our phones can keep track of who we have been near: this is great for checking for potential COVID-19 transmission, but also allows the holders of that data to record who our friends and associates are.[4] 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.[5] 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.[6]

While this 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. As a concept, contextual integrity helps define the social contract around the collection of data—and clarifies that legitimate 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. Where information is considered "already a public record," and the assumption is that any further use poses no ethical issues; thus, the digitization of property records or voter
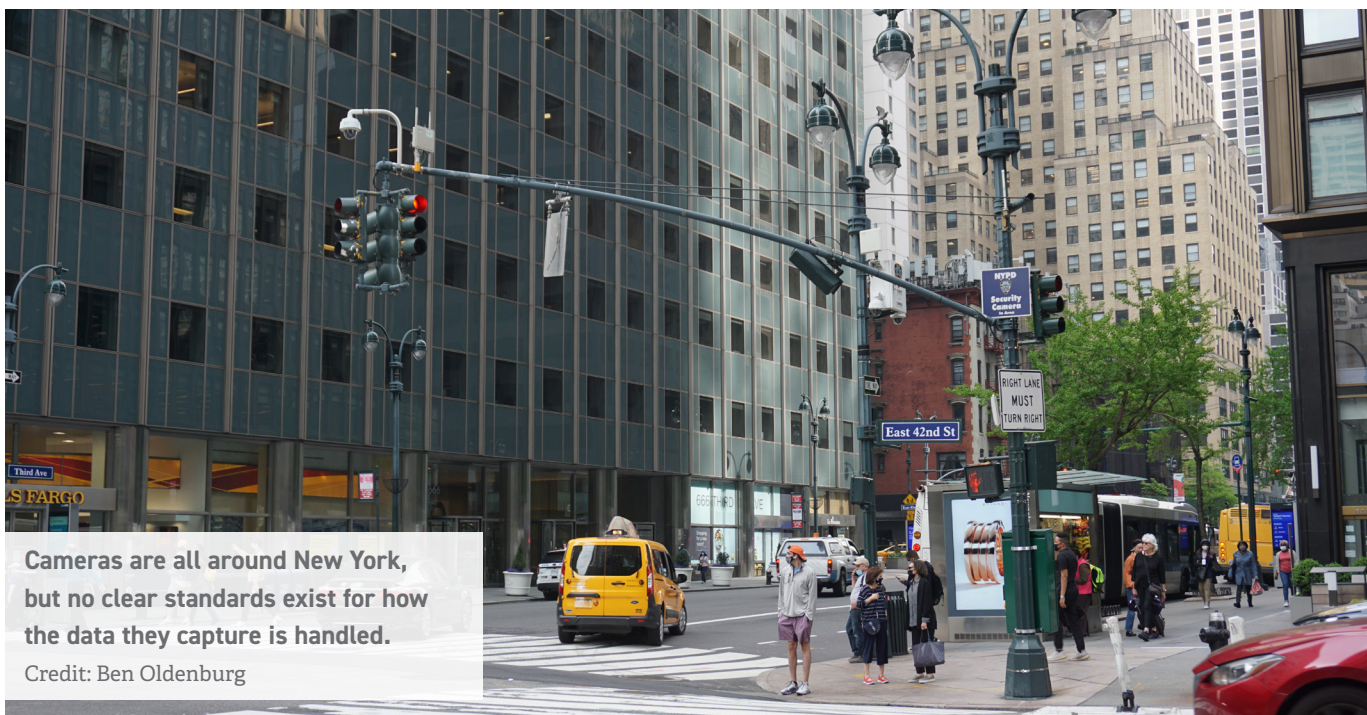
Cameras are all around New York, but no clear standards exist for how the data they capture is handled.

Credit: Ben Oldenburg

roles is not a violation.[7] If data is truly anonymized, there are no consequences to the individual, so there is no violation. And there are likely to be many 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 already instances where data is being used in ways that are unexpected but not illegal, and yield actions that could seem to violate contextual integrity. Human Resources Administration (HRA) uses income tax data provided by New York State to check whether Medicaid recipients meet the eligibility requirements, but such data matches sometimes ensnare people who were eligible at the time they applied, but later found work.[8] Several rent-regulated buildings in New York City have seen landlords install or seek to install facial recognition systems, which could monitor residents' movements much more closely than keys or even electronic fobs that can be handed from one person to another.[9] The switch to electronic fare collection systems on transit has meant that MetroCard data has been used in criminal investigations in New York for more than 20 years.[10] Misuse of facial recognition systems presents a potential new era of "digital stop

❝ **contextual integrity helps define the social contract around the collection of data**❞

and frisk."[11] In the 2010s, IBM used NYPD surveillance footage to develop biometric recognition systems that could search by skin tone.[12] And last year, NYPD monitored Black Lives Matters protesters and tracked them down by using facial recognition technology.[13]

NYPD's use of data highlights the extent to which one aspect of contextual integrity, and privacy in general, relates to the consequences of unexpected uses of data. The searchability of certain records might lead to embarrassment, which is one level; other data breaches might lead to job losses or discrimination; and, when law enforcement is involved, it could lead to being arrested—rightly or wrongly. 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.[14]

> **New York City's laws have not kept up with the evolution of technology"**

It also is a reminder that data analysis is not always reliable. It is widely understood that facial recognition technology is imperfect, especially with respect to minorities, but it can lead to arrests based on mistaken identity when, as often happens, people fail to question the results "of the computer." Other tools use algorithms that rely on data that incorporate historical biases and therefore run the risk of perpetuating them.[15] 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.

These issues are separated from the protection of consumer data that is gathered from our phones, computers, internet searches, purchases, and emails. At the heart of these transactions is just that: a willing exchange between each individual and the provider of the service. However flawed, these are governed by "terms of service" documents. 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.[16] 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.[17] NYDATA proposes California-style privacy protections given under the California Consumer Protection Act and the California Privacy Rights and Enforcement Act.

Public Data Collection

While consumer data protection is starting to be addressed, there has been less systematic work on public data — data 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 has 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.[18] (Notably, law enforcement data is also exempted from CPO oversight.)[19]

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 what 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.[20]

The concept of contextual integrity helps clarify that e-scooter users might well be comfortable with DOT having data that allows them to locate a scooter or fine a user or company for misuse. However, the provision of real-time data does raise the potential for such information to be shared with NYPD. The Identifying Information Law creates a caveat for permissions required from the agency privacy officer or the CPO for disclosures to the NYPD, "in connection with an investigation of a crime," whether committed, attempted, or impending.[21] 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 CCTV 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.[22] In fact, the ubiquity of cameras and sensors means that we are simply 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. The Mayor's Office for Information Privacy (MOIP) and office of the Chief Privacy Officer (CPO) were created by Local Laws 245 and 247 of 2017,[23] together known as the Identifying Information Law and codified into the City's Administrative Code under Title 23, Chapter 12. The Identifying Information Law forms the requirements for City agencies regarding the collection and/or disclosure of personal identifying information. 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. However, agencies may also implement their own policies, which take precedence if more stringent than the CPO's. Executive Order 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.[24] The Citywide Privacy Policy relies largely on the agency head's appointment of an Agency Privacy Officer to whom deference is given in the determination of what constitutes a "routine" or "non-routine" disclosure of sensitive information as the basis for appropriate data collection and disclosure. The main compliance functions are reporting requirements on their own policies to the Mayor, Council, CPO, and Committee every two years.[25] 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.

> **"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."**

The Need for Further Regulation

Overall, this lack of regulation and process has not served New Yorkers well. Even those who are unconcerned about their own privacy, who believe "I have nothing to hide," suffer. This is because concerns about privacy have hampered the City's ability to adopt and deploy technology that could improve the lives of New Yorkers. Automated license plate readers have aided in crime solving, yet when the technology itself is inaccurate—or used in connection to an unchecked system of policing that circumvents warrant requirements—have garnered great concern.[26] It has also been raised as a reason not to have agencies combine and share data even where such sharing is clearly in the public interest, and consistent with contextual integrity: presumably, New Yorkers want to Department of Education and the Administration for Child Services to be sharing data about kids in need of more education, 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 base of many of these concerns.

As a result, 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.

The technology opportunity

Establishing an overarching set of regulations and practices governing the City's data use requires thinking outside the current privacy discussion and looking at how institutional structures and practices have evolved to constrain other forms of activity by City agencies and private actors that impact shared spaces. In these cases, new constraints were imposed on City agencies that changed their behavior but did not impede their missions. In fact, thoughtful regulation can help facilitate what many agencies are legitimately trying to accomplish, while reining in overreach by others. It is actually in the field of regulating the private collection of data from public spaces that the most significant legislation is necessary, in large part because private actors may claim First Amendment freedoms around some uses.

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 the processes created in these laws have had unintended consequences, especially in the creation of ponderous processes that have drawn out decision-making, imposed disproportionate burdens on agencies, and in some cases given disproportionate

> **"**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."

power to a small group of stakeholder advisors whose views and expertise may not be representative or shared by a broad range of citizens. For example, Seattle's law requires that each new technology be approved by the City Council, and the disclosures required of City agencies have quickly turned into massive reports: a pre-approval report on law enforcement patrol car use of automated license plate readers was 349 pages long—prior to input from the Community Surveillance Working Group (CSWG), which reviews such reports.[27] In part, this is driven by the composition of the CSWG, which is statutorily composed of 7 members, of whom 5 must represent equity-focused groups.[28] 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.[29] 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.

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 environment 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 signifi-

cant public involvement. In the latter 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.[30]

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.[31]

While CEQR's hallmarks are disclosure and the risk of lawsuits, other oversight processes offer different approaches. The City Charter requires that all City procurement contracts be registered by the City Comptroller, giving that separately-elected official the ability to delay and challenge a City purchase, although ultimately the Mayor has the power to override the Comptroller's objections.[32] At the State level, public authorities such as the MTA must have their major purchases approved by the Public Authorities Control Board, composed of an appointee each of the governor, and the majority and minority leaders of the State Assembly and the State Senate.[33] Through this mechanism, the state's political leadership exercises tremendous control over these authorities.

The revised New York City Charter of 1989 attempted to create a layer of such oversight over City agency 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.[34] Chaired by the Public Advocate, COPIC could comprise the kind of non-mayoral check that the City's use of data seems to need, 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.[35]

Federal Examples

Beyond the municipal level, the regulation of data has often been as specific about how data can and should be shared as it is about how it cannot. 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, determined who is eligible to share such data, and what standards they must follow, and identified uses where the individual's consent is not needed, such as to share 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.[36] 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.[37] Similarly, as early as 1934, the federal Communication 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, but also made clear that companies may use such information for billing and the prevention of fraud.[38]

Implications for the City

While both HIPAA and the Communications Act regulate private holders of sensitive data, they do so in the 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 places a CCTV camera facing 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 reasons that CCTVs and similar systems are installed. However, the maintenance of contextual integrity requires that such entities embrace transparency about what they are doing and why, that such commitments are enforceable, and that data is not gathered for reasons tangential to the main purpose. For example, most New Yorkers would likely agree that CCTV for post-event crime analysis in front of a retail store is a legitimate use; but they would also agree that selling such footage to a company doing facial recognition training goes beyond the legitimate reason that a building owner might surveil a New York City sidewalk.[39]

One effort along these lines is the Digital Transparency in the Public Realm (DTPR) initiative. Started initially by Sidewalk Labs but 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 creating the means through a QR code for any passerby to find out more and be in touch with the collector of that data.[40] DTPR was piloted in 2020 by Boston's Mayor's Office of the New Urban Mechanics.[41] 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.

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 benefit, on the other hand, includes not just the overall justice of ensuring reasonable definitions of privacy are upheld, but also the potential to streamline data sharing where it is authorized and an increase in 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 by the City about individuals will be used only for the general purposes for which it is collected. While many City agencies have policies that suggest this, these do not have the force of law, and carry no penalty for violations. Further, it is left to the discretion of each agency's privacy officer—who works for the commissioner—or the City's Chief Privacy Officer, to determine what data requests are "routine."[42] 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 how personally sensitive data can be used, and explicitly sanction the sharing of that data among certain agencies for legitimate purposes. 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 Child 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

DTPR was piloted in 2020 by Boston's Mayor's Office of the New Urban Mechanics.
Credit: New Urban Mechanics / Nayeli Rodriguez

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 to the public outside of this legislative framework. The City should, however, as part of a comprehensive data audit make and document those determinations 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 provide 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), and the combined data used only for 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.[43] 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.[44] The law explicitly imposes a warrant requirement for law enforcement before they are able to access personal data collected by the authorities.[45]

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 — 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 both that City agencies will work expeditiously with the City Council towards 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, and especially exploring 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, and require 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.[46]

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 is comprised of a majority 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.

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 (such as MAC addresses) "sniffed" in public places.

The first requirement should be transparency: that CCTV cameras and similar devices be labeled, with easily-accessible, standard information including who owns and operates the device, what it is, what information is being gathered, what that information is being used for, and contact information.

The second requirement should be limitations on the resale or other reuse of such data for commercial purposes, and perhaps for all purposes.

It may be that the City Council should also create requirements for different types of uses based on contextual integrity. For example, a "security camera" could have a defined set of requirements—such as analysis only after the fact, destruction 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; so the rules surrounding a security camera would be inappropriate.

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.

Questions for discussion

1. Is the concept of "contextual integrity" a useful way to understand how the City should define and regulate privacy? In what ways does it fall short?

2. Is the concept of linking agencies together in clusters that share data, but walling them off from others, sound?

3. Does the idea of enhancing COPIC and giving it a meaningful oversight role make sense? Could it lead to unintended consequences that we should avoid?

4. To what extent is the idea of mandating private sector disclosure workable? How would it be enforced? Which City agency would enforce it? What kinds of penalties are appropriate for violations?

5. Does the proposal for requiring transparency from private-sector actors go far enough? Should certain types of data collection or use be prohibited or more tightly regulated?

6. How should algorithmic accountability be addressed in oversight? What are the short-term steps that can be taken?

7. Are there equity implications of this set of concepts and proposals that we have not identified? How should they be addressed?

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

The New York City government must be an effective purchaser, developer, and manager of complex technology solutions. Despite some notable achievements over the years, the City agencies tasked with technology are not properly organized, staffed, or equipped to do this. The result is that City technology is slow to evolve, costs too much, and underperforms in many respects. We recommend a consolidation of technology coordination functions that are currently spread across multiple agencies, the permanent establishment of a New York Digital Services team, and the overall supervision of technology-related agencies under a new Deputy Mayor for Technology.

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 over 3,000 curated datasets available through Open Data NYC,[1] begun to provide free Wi-Fi through Link NYC, 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 headcount[2,3,4] and outside contract spending,[5] the City has routinely been hampered by significant cost overruns for its large technology projects,[6,7,8] 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.

Three fixable problems are at the core of this dilemma: challenges hiring and retaining technical talent, an over-reliance 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 of them. New York's prominence has allowed it to attract top talent into such leadership roles as Chief Technology Officer 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, and 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, compared to the constraints of government, this is not surprising; several alumni of the City government expressed that public service was an inspiring and important part of their career, but that staying too long would lead to ossification of their professional skills.

A key challenge facing the hiring of more technology talent is that the City's approach to hiring is atypical compared to the private industry. While it is understood that the City often pays less than the private sector,

the gap can be stark when it comes to technology jobs, where the largest tech employers can sometimes pay two or three times more than City salaries.[9,10] 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 classified as "competitive class."[11] 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 with the offer of an online version of that test, this extra hurdle is an unnecessary challenge to recruiting. 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 job requires.

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 the relevant skills are used where they are most acutely needed — as an agency CTO, or in special projects, such as NYC Opportunity — making them unavailable to work in an ongoing way with the City's vendors. With limited staff capacity to manage consultants, vendors often work for City clients who lack the time or expertise to effectively manage them as closely as they should be managed, a leading contributor to expanding budgets.

The challenge of overreliance on external vendors appears clearly within the Quality Control and Systems Integration contracts, which are designed to leverage external expertise to ensure services are delivered on time, on budget, and appropriately integrated. In the private sector, firms rely on robust DevOps teams for integrating new systems, however the City routinely pays consultants upwards of $300 per hour for such work,[12] and the need for staff is constantly expanding. Increasingly, the City relies on Master Services Agreements (MSAs), which establish pre-negotiated rates

> **"**With limited staff capacity to manage consultants, vendors often work for City clients who lack the time or expertise to effectively manage them as closely as they should be managed, a leading contributor to expanding budgets."

for hardware and services and have the benefit of accelerating the time it takes to procure new hardware and software,[13] but come with the challenge of limiting vendor options and reducing transparency. In 2015, DoITT signed a 5-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.[14] DoITT signed a new 5-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.[15] As the terms of these contracts and exact use of funds are confidential, it is difficult to determine whether these expenditures reflect desperately needed products and services, or mismanaged contracts.

As the City's spending on technology has ballooned, DoITT has concentrated its spending in fewer, but much larger, contracts, reducing the overall number of active contracts from 667 in FY14[16] to 438 in FY21.[17] In FY14, DoITT had 46 active MSA Contracts totalling $563.54 million.[18] Today DoITT's 43 MSA Contracts total $2.73 billion.[19]

Master Services Agreements are not the only tool the City has at its disposal to procure technology outside of traditional methods; another approach is through Demonstration Projects. Demonstration Projects are allowable under a defined process by the City's Procurement Policy Board wherein City departments can work with outside vendors to test innovative ideas and solutions.[20] In a fast-changing field such as technology, it's easy to imagine that many technology solutions would 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 contracts were classified as Demonstration Projects, and none of them 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 reticent to replicate those efforts for in-house technology, relying heavily on Master Service Agreements instead.[21]

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 about specific projects. DoITT handles the bulk of the City's IT systems, technology-related franchises, and service contracts. The Chief Technology Officer (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 (CPO) 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[22] to manage the City's IT infrastructure, DoITT was primarily tasked by Mayor Giuliani with evaluating, decommissioning, and replacing the City's IT systems in preparation for Y2K.[23] Not surprisingly, over the past two decades, DoITT's scope has expanded significantly to include managing the City's telecommunications and cable franchise agreements, operating the City's 311 system, and overseeing the City's multi-million dollar hardware, software, and service contracts with private vendors. In addition to the department's growth in scope has been

a growth in its headcount. The Bloomberg Administration oversaw a four-fold increase in DoITT's full-time staff, from 286 employees in 2001[24] to 1,162 in 2013.[25] By 2020, they employed 1,823.[26]

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.[27] 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."[28] Although that report is now almost ten 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, may have served to keep DoITT from accumulating 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,"[29] in practice, the CTO's office has focused on broadband strategy, and the CTO actually has limited control over that, as oversight of the companies providing internet access in New York resides with DoITT.

Further, while most of the technology-related agencies report up 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 examples of solving it 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. 18F, housed within the General Services Administration (the Federal equivalent of DCAS), offered technology services to other Federal agencies on their priorities. USDS, housed within the Office of Management and Budget—effectively a wing of the White House itself—tackled White House priorities, often when there is 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.[30]

What both 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 creating 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, they updated their application standards, their response times, and their ability to seek out and find promising candidates in ways that directly drew from the hiring practices of technology companies.[31]

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 City government; it attracts applicants from across the

> **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."**

United States (and beyond) and many of its participants go on to have long careers in the civil service. A similar program exists to recruit CUNY students, as well.[32] 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.[33]

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 more iterative, smaller contracts. Traditional contracting seeks to identify what technologies need to accomplish in advance, and then hand off specifications to a vendor to build it and wait for it to be delivered. However, it is far better to embed a City staff member, who fully understands the need, and who can work closely with the vendor to make sure that the project stays focused on its goal, but also evolves as it develops. This is especially important when designing systems for the general public to use, where user testing and iterations are important. Significantly, the Master Service Agreements should make this 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.

The competing needs for cross-cutting integration and a narrow mission-focus have left cities across the United States with different approaches to organizing their technology functions. Seattle's Chief Technology Officer 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. Although this wide-ranging department was highly criticized for poor management until several years ago, a new director, Saad Bashir, was appointed in 2019 and has demonstrated the power of concentrating leadership across all aspects of technology in one individual.[34] 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.[35]

An agenda for the next administration

To make the City a first-rate purchaser and developer of technology products, we propose a narrowing of the scope of work of the Department of Information Technology and Telecommunications (DoITT), the permanent establishment of a New York City Digital Services team, and a realignment of the City's technology departments under a newly established Deputy Mayor for Technology. These initiatives will require the joint efforts of the Mayor, the City Council, and the Comptroller.

1 **Create a New York City Digital Service (NYCDS) 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 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. However, it would embrace and scale the notion of targeted hiring outside of civil service processes on fixed-duration contracts to expand the number of technology experts that are available within the City.

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 them determine how to use technology wisely, how to craft projects and contracts, and could 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 seconded to agencies for work on specific major projects, or as ongoing advisors to key officials, following the model of the Urban Fellows program.

An important point is to ensure that NYCDS is not limited to starting 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 be successful, NYCDS will need to be authorized to start with at least 100 people in order to have scale and breadth.

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.

2. 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 approach to technology purchasing to one that incorporates greater oversight of vendors and embraces 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.[36,37] 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 meet the needs of its end users.

2. DevOps: The City's systems integration specialists should be involved in software development from the onset to ensure tools being built externally can be integrated with 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 under-performing vendors before costs spiral out of control.

3. Break up DoITT and place its components and other technology agencies under a new Deputy Mayor for Technology

To bring both focus and breadth to the City's overall technology effort, the next Mayor, with the support of the City Council, should split up DoITT and reorganize it and other relevant agencies under a new Deputy Mayor for Technology, who would also serve as the City's CTO.

One of DoITT's challenges is that it oversees systems that are simply too diverse and too complex for one agency. We conclude that DoITT's focus should return to the core IT infrastructure needs of the City, ensuring City departments have the appropriate hardware and software for accomplishing their day-to-day responsibilities. While much of this report's agenda is focused on procuring and managing cutting-edge technologies, the vast majority of the City's technology needs can be met by well-managed existing tools.

Some of DoITT's functions would be split out to new agencies under the same Deputy Mayor. Oversight over telecommunications franchises should be shifted to a new Broadband Development Corporation, as described in "Broadband" (Chapter 2.1); and it would likely be beneficial for 311 and NYC.gov to be a part of a separate Public Engagement Unit.

In addition to these now-smaller agencies, the new Deputy Mayor would also oversee NYC3, the CPO, MODA, NYC Opportunity, and the Department of Records and Information Services, as well as the NYC Emerging Technology Advisory Panel recommended in "Futureproofing"" (chapter 5.1).

With this broad set of agencies under their purview, the new Deputy Mayor would be able to fulfill the CTO's stated mandate of, "developing and implementing a coordinated citywide strategy on technology and innovation." This new Deputy Mayor would be able to establish a broad, cross-cutting 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, and would allow them to focus narrowly to achieve their important goals.

4 Conduct a broad inventory of the City's technology, and update it regularly

The COVID-19 pandemic has highlighted the City's reliance on technology for continuing 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 school children,[38] increased remote access for City employees,[39] and rushed to make more City services available online.[40] All of these actions have added to an already exhaustive list of City-owned hardware and software that must be managed for their entire technology lifespans.

While developing and procuring new tools and services is a critical component of technology management, so 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 these types of exhaustive audits 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.

Privacy and equity concerns

We have identified no privacy issues this set of proposals raises.

With respect to equity, one opportunity exists to use the proposed NYCDS to recruit technologists from under-represented groups into the unit. However, as NYCDS is not intended to be an entry-level opportunity, it will not be well suited to actively increase the number of minorities in technology.

Questions for discussion

- Does this chapter accurately diagnose the challenges with the City's efforts at purchasing and managing technology implementations? Are there aspects of the challenge that we are missing? Are we being overly negative about the City's capabilities in this regard?

- Does the NYCDS concept work? Would it achieve what this chapter intends? What challenges would exist to getting it created?

- Is the proposed model of vendor management likely to make the City more effective at technology implementation?

- Is the proposed reorganization of technology agencies a good idea? What problems might it cause? Are there benefits to it that we have not noted here?

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1.3 Additional concepts under consideration

The problem of evaluating and regulating police technology

In all of our discussions about privacy, the question of police technology in general and surveillance particular arose very quickly. Our proposal on privacy addresses the question of interagency data sharing, which would cover NYPD. However, there remains the question of how NYPD deploys technology.

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.[1] 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 many have credited it with the drop in crime between the late 1990s and the late 2000s. After 9/11, NYPD has invested millions, if not billions, in surveillance technology comprising 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. Most recently, NYPD demonstrated the use of a robotic dog.

Many people we spoke to, and many reports and articles we read, however, question the NYPD's surveillance efforts, both in terms of their appropriateness and their efficacy. Some have raised concerns about Comp-Stat itself.[2] Others cite NYPD's missteps with respect to surveillance and data, such as its surveillance of Muslims and the sharing of footage with IBM to train IBM's biometric recognition systems.[3, 4, 5] In 2020, NYPD monitored Black Lives Matters protesters and tracked them down by using facial recognition technology.[6] There have also been documented instances where the NYPD—either as an organization or individual officers on their own—have skirted the need to obtain a search warrant by using technology and private sources of data to obtain information that would otherwise require a search warrant or is against NYPD policy, such as the use of stingrays and rogue use of Clearview AI.[7] Most recently, NYPD's new "robot dog" has raised questions about its ability to adopt new technology without oversight.[8] 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.[9]

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.[10]

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 US 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.

Questions for discussion

- What evidence exists as to the efficacy of NYPD's surveillance operations?

- To what extent should, or could, the City Council create a committee empowered to oversee intelligence but also to keep sensitive knowledge secret?

- Would a separate agency to manage intelligence alleviate some of the concerns people have expressed about the NYPD's operations? Would splitting intelligence and enforcement, following the federal model, be helpful or would it undermine the efficacy of NYPD operations?

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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 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 not just a luxury but a means to alleviate the problem of time poverty.

These inequities are a challenge for our city in two ways. First, they are an inequity in and of themselves, keeping some New Yorkers from obtaining some of the benefits of 21st century living. But they create a broader challenge to all New Yorkers as well, because 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

New York City's digital divide is rooted in the fact that 29% of New York City households lack broadband access. The de Blasio Administration's Internet Master Plan, released in January 2020, proposed a bold, comprehensive effort to create a City-owned fiber network to fill in this gap. Overall, we find that the next mayor and City Council should pursue this vision, but realizing it will require creating a Broadband Development Corporation (BDC) with a dedicated revenue stream and bonding authority, data-gathering power, and a multi-decade mandate to create a citywide network of utility corridors.

The problem we face

The COVID-19 pandemic has further demonstrated the need for broadband internet in order 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 it is certain that doing so will not permanently disadvantage New Yorkers who cannot afford broadband service or whose building is not served by broadband.

Many New Yorkers still lack broadband access. 29% of New Yorkers have no broadband access at home, and 18% have no internet connection at all, including via mobile phone. Predictably, this is highly correlated with income: only half of households living in poverty have broadband access, and one-third of all non-White New Yorkers lack broadband.[1]

The broadband gap may soon get even worse. Current access data is based on the Federal Communications Commission's definition of "broadband," which has not been updated since 2015, and is likely to be increased to meet the growing demand for speed and bandwidth.[2] Even before COVID-19, everyday demands for internet access had been steadily increasing at approximately 21% each year, with no signs of slowing down.[3] The pandemic accelerated this trend, especially with the need to upload data to the internet, driven largely by the widespread adoption of online meetings. 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%.[4] As a result, before long, many connections now classified as "broadband" will become obsolete, because internet connections provided over telephone lines (Digital Subscriber Line, or DSL) and coaxial cable (using cable television infrastructure) are not expected to be able to provide the fast download and upload speeds people will need.[5] Future connectivity is expected to require the speed and symmetrical transmission that only fiber optic lines afford.
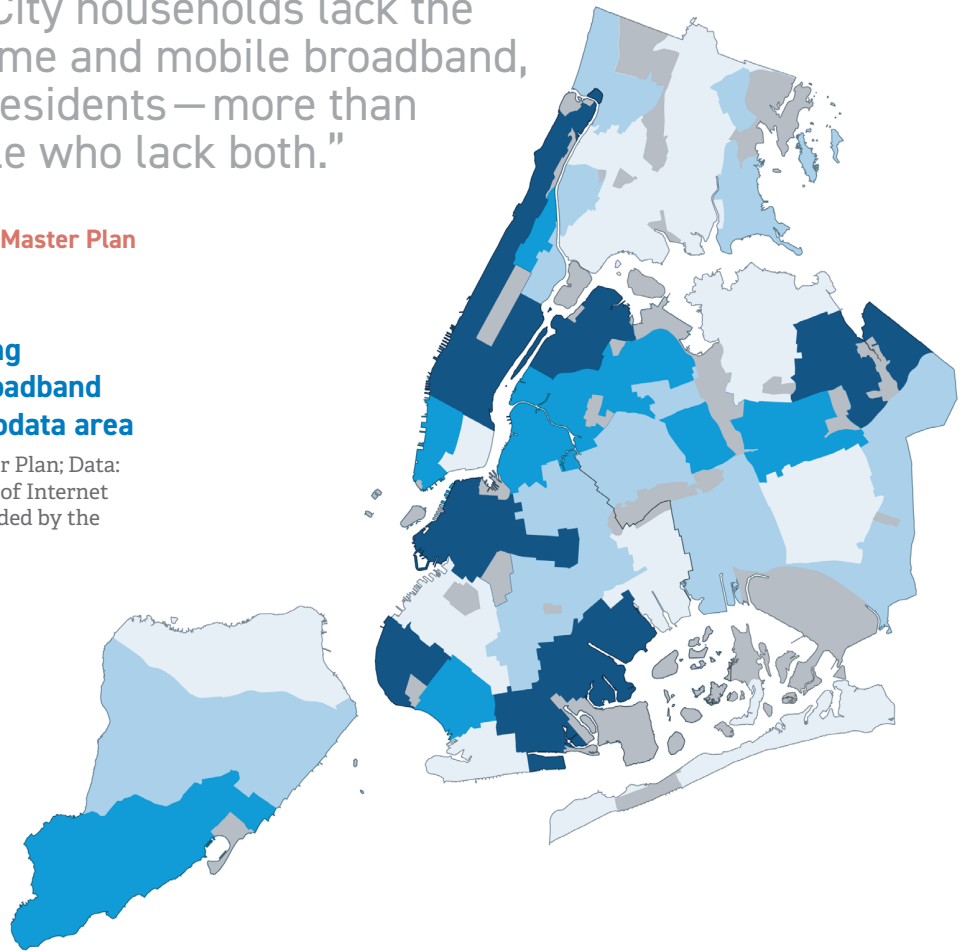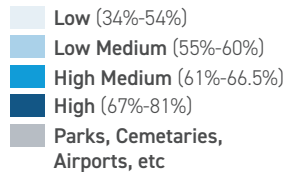
Lack of comprehensive broadband access is driven by both limited availability and high costs. For some, broadband access may be available but too expensive. New York State recently passed legislation mandating $15 internet service for some low-income households, an action that should mitigate cost as a driver for eligible

" **40% of New York City households lack the combination of home and mobile broadband, including 18% of residents—more than 1.5 million—people who lack both."**

— **The New York City Internet Master Plan**

A map of New York City showing combined home and mobile broadband adoption rates by Census Microdata area

Source: The New York City Internet Master Plan; Data: 2017 5-Year Estimate of Presence and Type of Internet Subscription in the Household data, provided by the American Community Survey.

▢	Low (34%-54%)
▢	Low Medium (55%-60%)
▢	High Medium (61%-66.5%)
▢	High (67%-81%)
▢	Parks, Cemetaries, Airports, etc

families.[6] But for hundreds of thousands more New Yorkers, broadband access is limited by their building, or even their entire block, lacking a network connection.

New York's current gap in broadband connectivity comes at the end of more than a decade of trying to achieve universal coverage through the private sector. In 2008, the Bloomberg Administration entered into a franchise agreement with Verizon that committed the company to bring fiber to all homes in the city by 2014. In 2017, the City took Verizon to court arguing that it had failed to fulfill its commitment, which led to a settlement requiring Verizon to hook up an additional 500,000 homes by 2023 and prioritize installations in low income neighborhoods or risk paying a fine up to $7.5 million.[7] After the addition of these homes, however, it is still expected that not all New Yorkers will have access to broadband.

In January 2020, the Mayor's Office of the Chief Technology Officer (CTO) issued the *Internet Master Plan* (IMP), an ambitious look at the city's broadband gap. The IMP concluded that ensuring universal coverage and protecting ongoing service quality and prices requires the City to develop a citywide open-access fiber network to each intersection, with the final connection to residents 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.[8] The first significant action to come from the IMP was a request for proposals (RFP) released by the Department of Information Technology and Telecommunications (DoITT) on March 3, 2021, committing $161 million for the acquisition or construction of open-access broadband infrastructure. The RFP emphasized a focus on East New York, Brooklyn, one of the areas of the city most impacted by COVID-19.[9]

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 broadband access. However, there is significant concern about the city's governance and operational structure for ensuring the network is built, and that the approach leaves opportunities for grid resiliency and long-term cost savings unrealized.

The most important challenge facing the IMP's realization is that this multi-billion-dollar, multi-year project has neither a dedicated budget, funding stream nor institutional home that is focused on 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. (See "Administration", chapter 1.2) Further, the overall project of a city-wide fiber network is as much a construction project as it is a technology project, 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 it 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, multi-year 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, with some overlap with underground). Where the poles have capacity, stringing fiber on overhead poles is much cheaper than 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, which is far less vulnerable to storms due to its underground infrastructure.[10]

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 re-installed whenever streets are reconstructed, and is susceptible to unintentional service outages caused by the frequent utility work projects that cut into New York City's streets.[11] 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.

A third concern is that the IMP calls for leveraging the presence of the Verizon-owned Empire City Subway (ECS) system, but is unclear on how it will do so. ECS is a network of utility tunnels in Manhattan and the Bronx, constructed under a franchise agreement with the City dating to 1891. 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, but has not carried those benefits to the residential market as there has been minimal investment in expansion and upkeep that doesn't directly benefit its parent company (Verizon). 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.[12]

Finally, it is clear that the IMP was hampered by an inability to get good data on broadband access across the city. Many of the IMP's charts and maps reflect a valiant effort to understand broadband access without complete information. While the City mandates that residential building managers turn over lots of information — ranging from window guards to energy consumption to profitability for buildings with rent-stabilized units — all information about whether a building has access to the internet is held by the building itself and the Internet Service Providers (ISPs) in the neighborhood, which are often reluctant to share data. The building connection in particular has been a source of controversy, as Verizon claimed that building owners were a major barrier to universal coverage, while

others claimed that Verizon demanded unreasonable agreements from buildings to connect to the network.[13] Regardless of which side is correct, the lack of visibility into this critical 'last mile' gap is a challenge to understanding the progress of the ambitious project envisioned by the IMP.

The technology opportunity

If a new administration marshals its resources and authority, the City is well positioned to realize the promise of the Internet Master Plan, improving access and resiliency city-wide.

Local development corporations

A key tool the City can use to implement the IMP's vision 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."[14] An LDC can operate as an arm of municipal government, and can issue its own debt, but can avoid some of the constraints of government, including the debt ceilings imposed on municipal governments.[15] 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.[16] New York City had at least 19 LDCs as of 2019, the most prominent of which is the New York City Economic Development Corporation (EDC).[17]

An LDC focused on broadband would be the natural entity to manage the City's telecom franchises, which the City Charter vests with DoITT.[18] These franchises yielded $146 million in Fiscal Year 2021, which currently go into the City's general fund.[19] If channeled into an LDC, however, these 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 over 100,000 city assets such as street furniture, utility poles, and rooftops available for potential wireless telecommunications siting. It could also grow if the new LDC was able to manage the City's franchise port-
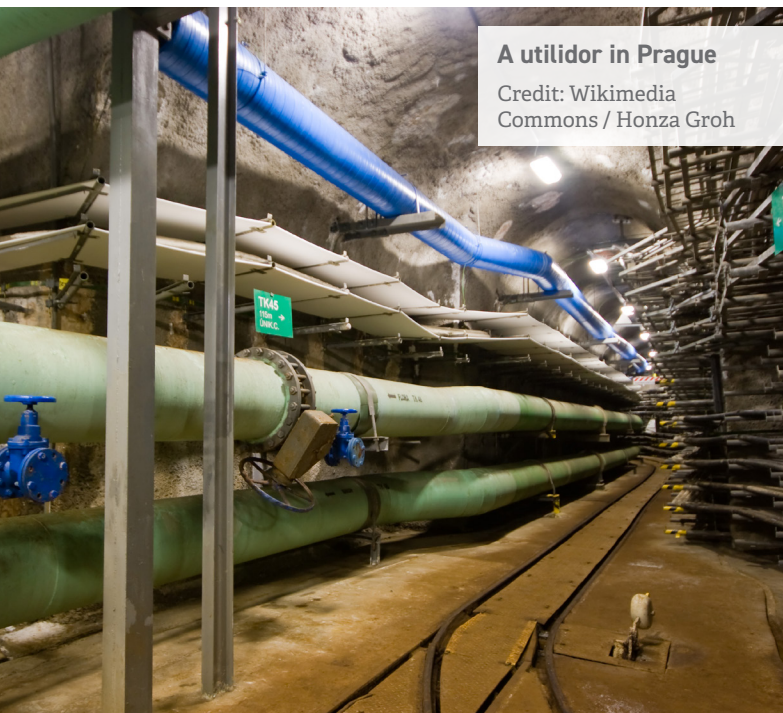
folio strategically, leasing space on its network to new competing service providers or even offering broadband service itself.

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, their usefulness is limited to the duration of the street pavement itself, as road surface reconstruction all but guarantees the need to replace the conduit given its shallow depth.[20] 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 long-standing 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 much of their municipal utilities into these underground tunnels, and the City's Department of Design and Construction (DDC) has been studying the concept for several years.[21]

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.[22] If an LDC were empowered to use those cuts to install sections of tunnel wherever large-scale construction was already underway — such as when DOT redesigns a street — it could, over time,

A utilidor in Prague

Credit: Wikimedia Commons / Honza Groh

"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."

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 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 with the city), and it has also failed to expand its network into more areas of Manhattan 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 not to be in 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.[23]

Data gathering from buildings

Across the United States, the measurement of broadband access has proven problematic. The federal government collects data from telecommunications companies directly, but data is collected only at the census tract level — so if at least one home in the census tract has broadband access, federal data shows every home in that tract as having access. As a result, critics have argued that existing data consistently overstates access.[24] As a result, the IMP relied primarily on census data asking whether respondents had a broadband connection — leaving open the uncertainty as to the cause: whether they had access but chose not to subscribe, whether their street had broadband but their building was not connected to it, or whether their street had no broadband access at all.[25] This is a critical distinction, because it leaves policymakers uncertain as to whether the cause lies with the utilities, the building owners, the cost of the service, or the preferences of the subscribers themselves.

New York City has routinely struggled to obtain detailed data from telecommunications providers about internet access and the location of existing fiber.[26] 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

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

and building managers solicit data from tenants about the presence of window guards.[27] Local laws mandate that building owners submit detailed energy consumption data through an annual form to the Department of Buildings.[28] 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.[29] 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.

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. 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 city-wide 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 Ensure the BDC can coordinate the activities of other city agencies

Constructing a city-wide 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:

- NYC 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;

Cross-cut of city infrastructure

A graphic demonstrating the different existing and future public assets that can be leveraged for a city-wide open-access network of conduit and wireless infrastructure.

Wireless/5G

Wireless/5G

LinkNYC

Building Connection

Network Hubs

Microtrench

Future Utilidors

ECS Trenches
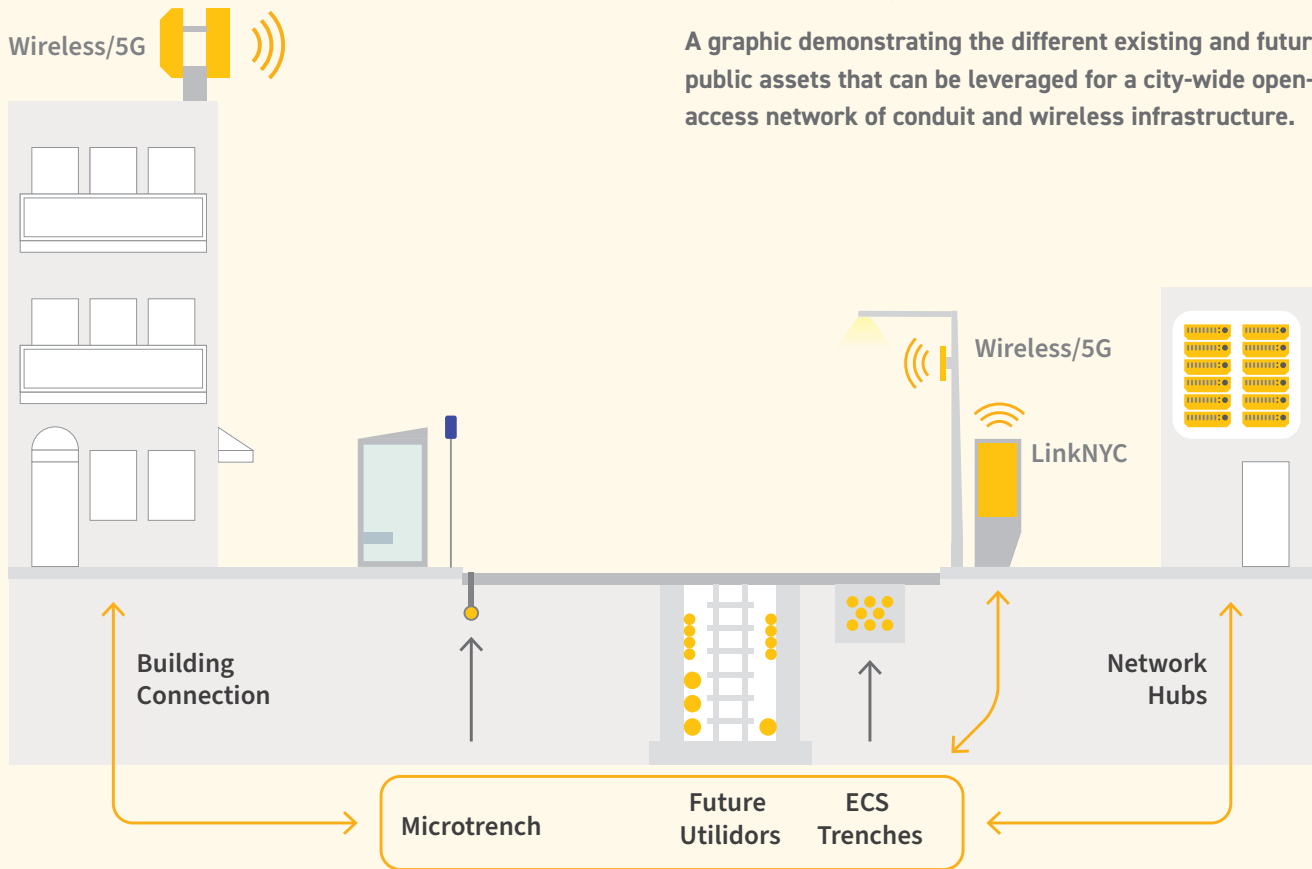
- the Fire Department, which has both a permitting role and is constructing its own fiber network;

- 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. Procurement.

sively to ensure that it is meeting its open access mandate, raising revenue, and using it 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 city-wide utilidor network, or to re-bid out the contract under new terms.

3 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 aggres-

4 **Institute two approaches to gather data on broadband access: annual reporting from building owners, and including 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, HPD 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.

Privacy and equity concerns

We have identified no privacy concerns with these recommendations. The data being sought about building broadband connections does not touch on personally identifiable 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.

Questions for discussion

- Most of our research and interviews have indicated widespread support for the vision embraced by the IMP. Are there flaws in the IMP that we should take into consideration?

- What are the downsides of creating a local development corporation to manage the delivery of broadband internet? Are there reasons we have overlooked that this mission should remain within DoITT?

- Is the idea of using the BDC to pursue the long-term objective of undergrounding overhead utilities misguided? Is it — as we see it — a way finally to realize the objective of better utility service outside Manhattan, or is it a costly distraction that could delay the realization of universal broadband access?

- Most of our interviews and research focused on the problems associated with broadband access in the parts of the city characterized by multi-family apartment buildings. However, many New Yorkers live in its roughly 750,000 single-family homes. To what extent are the issues relating to broadband access the same or different in these neighborhoods? Are the recommendations in this chapter relevant to these neighborhoods, or are different or additional strategies necessary to serve these New Yorkers?

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2.2 Additional concepts under consideration

The problem of electronic payments

The world is increasingly shifting to a digital payments economy. The share of total retail sales in the US through e-commerce 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 the e-commerce share reaching 14% in 2020.[1] 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%, and in 2018 debit cards surpassed cash as the most popular in-person payment type.[2]

Digital payments systems offer users a range of benefits including efficiency and convenience, while the costs 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), and lack of access to goods when brick and mortar stores close.

Households without access to a payment card, 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.[3]

While the broadband chapter offers solutions to address digital exclusion for New Yorkers, the challenge of financial inclusion remains very difficult to solve. As of 2017 an estimated 11.2% of New York households did not have a bank account (vs 6.5% nationally), and 21.8% were underbanked (vs 20% nationally). Many of these households are in neighborhoods with higher shares of Black residents, Hispanic residents and low-income residents.[4] Therefore the problem of digital commerce exclusion is worse for those same households already struggling with economic security and mobility and 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

Questions for discussion

- To what extent are unbanked New Yorkers really cut off from the digital economy? Are prepaid debit cards and similar tools sufficiently available to them without an intervention?

- Are traditional bank accounts truly necessary for financial inclusion, or are other means — such as debit-only accounts and forms of mobile payments — sufficient given the changing nature of banking?

- Are there other ways to enable unbanked New Yorkers to participate in electronic payments?

The problem of package delivery

Internet access is necessary but not sufficient for all New Yorkers to participate fully in the internet economy. Despite having negative impacts on traffic congestion and local retailing, there is no question that e-commerce is 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 it offers benefits from saving 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 have 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. Significantly, delivery companies report that making deliveries to NYCHA buildings can be extremely expensive.

While often portrayed as a luxury, delivery services may be highly relevant to the needs of low-income New Yorkers. Internet-based sales offer a wide variety of choice, and often lower prices than local retailers; this threatens to recreate the problem of food deserts, where low-income New Yorkers are often forced to pay 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 a shared facility operated by a third party franchisee 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.

Questions for discussion

How much of an issue is this? Are New Yorkers who live in apartment buildings without doormen simply finding other ways to get their packages? Delivery companies are developing creative solutions such as paying fees to local retailers to receive packages for neighbors. Is this a problem that does not require

Is the on-demand economy useful to low-income New Yorkers? Or is the conventional wisdom that it is mainly a luxury more correct?

If it is a problem that the city should address, do any of the potential solutions seem more promising than the others? Or are there other potential solutions we have not identified yet?

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3 Optimized 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 and when we cross the street, when we send our kids to school and when we take out the trash, we rely 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 solutions range widely, including data-gathering systems, new ways for City agencies to share data, and new standards for the City to require of businesses. In some cases, these 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 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 knows, New York City'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. Cameras and digital tools can allow us to make it possible to reserve parking spaces, eliminate double parking, and enforce traffic laws thoroughly.

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 has become even more important as a result of COVID-19.

At its root, a fundamental need facing 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 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. 240 people died on our streets due to traffic crashes in 2020. This total includes 86 pedestrians, 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.[1]

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 failures 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, and made 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.[2]

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 (BQE) (Interstate 278) through

> **There's a single reason we don't enforce and manage our streets well: using traditional methods, it's basically impossible"**

Brooklyn Heights indicated that more than 10% of all trucks were overweight, with some weighing as much as double the legal maximum.[3]

The third way we see this problem is at the curb. By definition, every vehicle trip starts and ends the same way: pulling up to a curb, 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; 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. And 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 rider to emerge from a building, rather than fast pick-up resulting from a street hail.[4]

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 leads to increasingly unsafe conditions on the roads, and backs up traffic.

There's a single reason we don't enforce and manage our streets well: using traditional methods, it's basically impossible. The problem of enforcing a moving violation is that, by definition, the violator is moving. The traditional 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.[5] 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 the City of New York. Enforcing parking violations

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.[6]

Even significant "blitzes" focused on enforcing traffic laws with traditional means have little impact. And evidence clearly suggests that police target minorities unfairly when enforcing traffic laws, and traffic stops are the most frequent source of police interactions for people of color — often, unfortunately, with deadly consequences.[7]

Managing the curb is even more difficult. Matching supply to demand requires work. Private parking garages often employ a valet to ensure space is used optimally. Restaurants take reservations to ensure that a guest 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 a lot 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.[8] In 2014, the City was able to install its first speeding cameras, a program that has now been expanded to include 750 zones (areas within one-quarter-mile of a school) and a total of 2,000 cameras. At the

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.
Credit: Ben Oldenburg

moment, the cameras are only operational between the hours of 6:00 am and 10:00 pm.[9] In addition, the City is now using cameras to enforce dedicated bus lanes.

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.[10] 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.[11]

While New York City has implemented camera-based enforcement of moving violations more than any other American city, many global cities use this tech-

nology 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.[12] These began as film-based 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.[13] At least in some parts of London, all enforcement of non-criminal moving violations (such as illegal turns and lane changes) are conducted via cameras.[14] Several cities in Europe and Asia have relied on camera-based enforcement since the 1960s.[15]

Similarly, cameras combined with scales embedded in the pavement can weigh trucks while they are driving at highway speeds and then photograph the truck and its license plates.[16] In Europe, Hungary implemented a national system of automatic truck weight enforcement on its roads in 2018, using technology from a Swiss company, Kistler.[17] The state of Indiana has been using cameras and scales provided by Kapsch, a traffic technology company, in a pilot.[18] 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.[19]

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. The City of 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 illegally-parked vehicles that received tickets by a factor of 14, and could also integrate 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.[20] Closer to home, the Village of Scarsdale, New York, implemented a mobile ALPR system for parking enforcement in 2018. According to village officials, an immediate finding was that several vehicles 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.[21]

New York has been slow to adopt digital technology for parking enforcement. It moved away from traditional parking meters with the switch to the Muni-meter (first 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.[22] However, the NYPD uses mobile automatic license plate recognition software for surveillance, but not for parking enforcement.[23]

Camera-based enforcement offers three main benefits.

The first benefit 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.[24]

The second is that camera-based enforcement reduces the potential for bias or favoritism in how laws are applied to citizens. Evidence suggests that police nationwide, and also in New York City, disproportionately target minorities in enforcing traffic laws.[25] 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 affiliated with law enforcement.[26] 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 violence in ways that were disproportionate to the reason for the stop, and disproportionately against people of color.[27] This recommendation was underscored in her 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 resulted in Feliz being shot and killed by the officer. While the investigation did not find the officer's action 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, tense situation that was out of proportion to the violation.[28] The fear that drivers 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.[29]

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

Credit: Coord
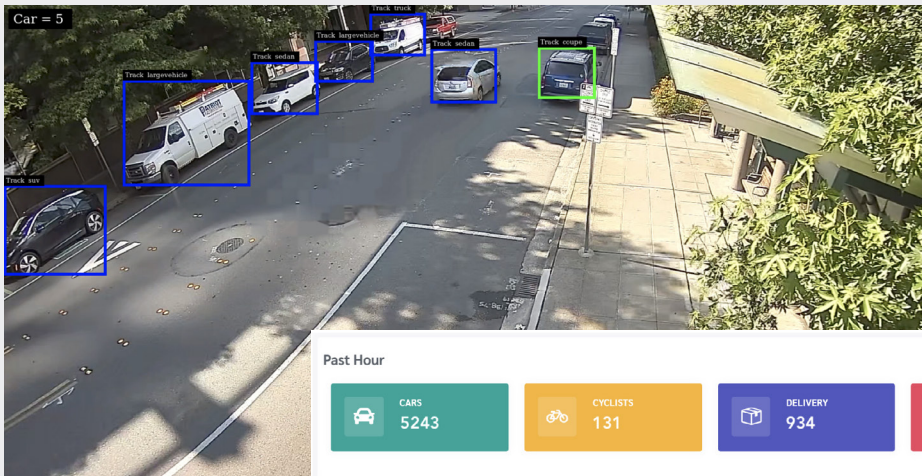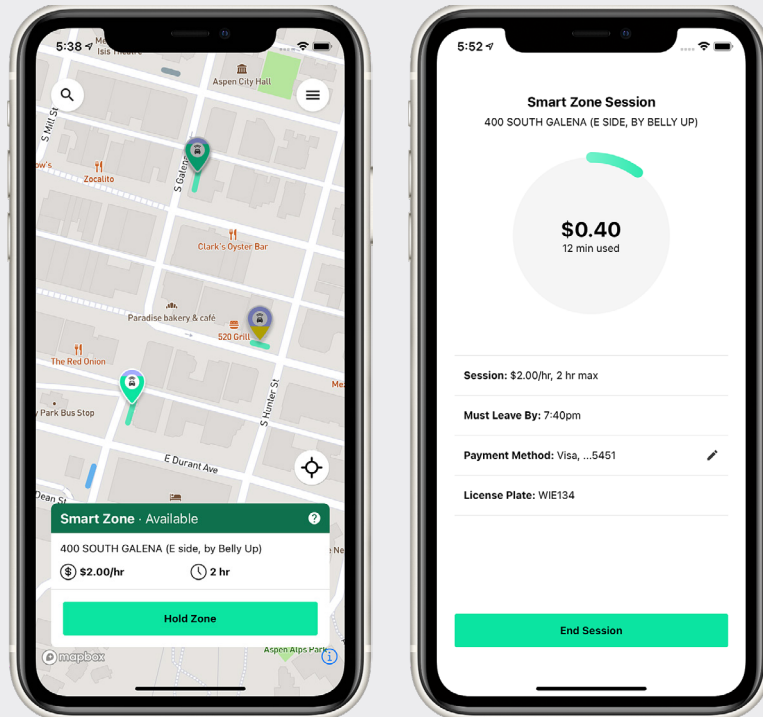
Automotus uses computer vision technology to monitor and enforce curb usage.

Credit: Automotus
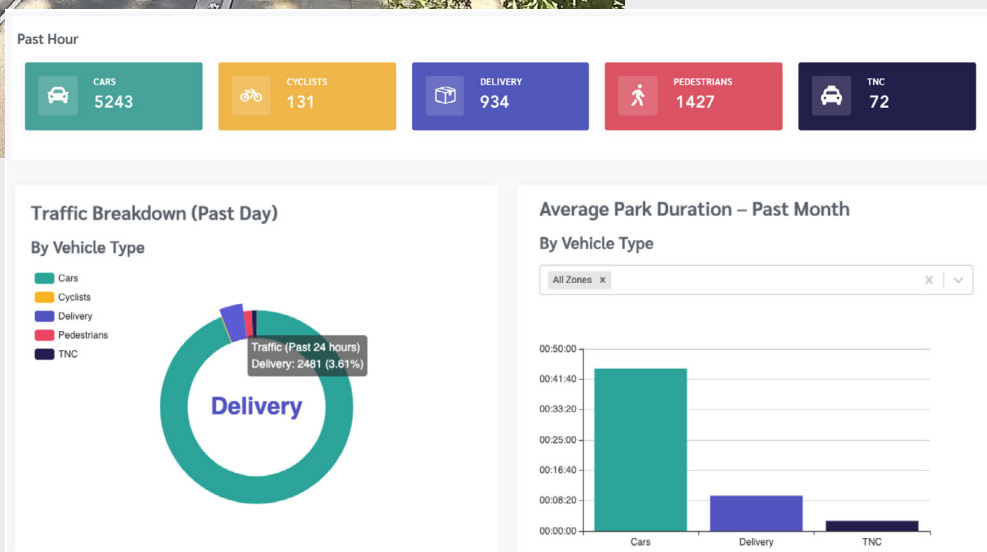
While a pervasive, fine-based system could have disproportionately negative impacts on low-income drivers, recent legislation helps ameliorate this impact. New York State recently enacted the Driver's License Suspension Reform Act, which replaced the practice of suspending someone's license for unpaid tickets and allowing the creation of a payment plan capped at 2% of the individual's monthly income.[30] 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. Washington, 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.[31] The City of 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.[32] Santa Monica, California, is undertaking a similar pilot with a Los Angeles-based company, Automotus.[33]

> "technology can actually prevent drivers from making mistakes, not just catch them doing so."

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.[34]

Although not yet in widespread use in vehicles, it is likely that such technology will 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.[35] Despite Brexit, the United Kingdom has announced it will maintain the new mandate as well, citing its safety benefits.[36] 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.[37] In New York, Revel mopeds use similar technology to govern their usage in parks and other areas.[38] 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.

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.

Digital tools can manage New York City's streets to improve safety and reduce congestion.

Red Light Cameras

Speed Cameras

Weight Sensors for overweight vehicles

Automatic License Plate Recognition (ALPR) for traffic enforcement vehicles

Unbiased enforcement of (**a**) vehicles blocking lanes, (**b**) existing parking rules, and (**c**) placard abuse

Reservation based pickup & delivery spaces

Explore requiring speed limiters on TLC-licensed vehicles
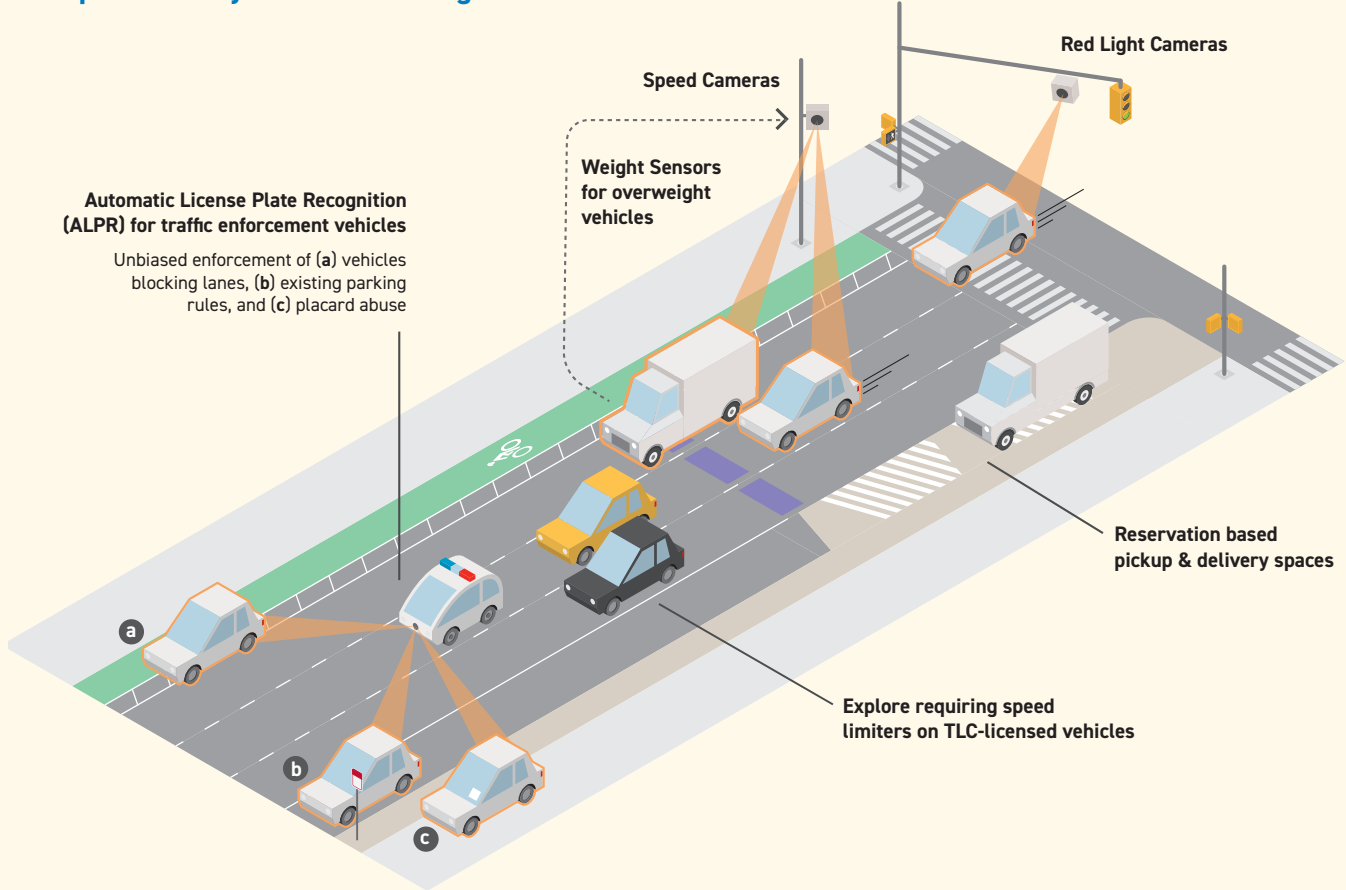
1 **Build out a complete network of enforcement cameras immediately and use them to the fullest extent of City authority**

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 TLC-licensed drivers. It should fully make use of these powers. Doing so would require the following steps:

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

It is the stated intention of DOT to implement the authorized limit of 2,000 cameras in the City's 750 school zones before the next Mayor comes into office, but if implementation falls 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, and 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.[39] 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.[40] 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.[41] 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 in 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.[42]

The incoming administration should move aggressively towards 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 prevent 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.[43] The City's red-light camera program has had similar results.[44] ALPR-based parking enforcement programs elsewhere have shown that they recover their capital investments in months or weeks, rather than years.[45]

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, predicting where crashes will occur based only on prior crash locations will fail to capture many locations where a redesign is in question. 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.[46] 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.[47] In 2019, a delay due to Republican State Senators holding the issue hostage allowed the program to lapse, the Legislature passed S. 4331/A. 6449, sponsored by Senator Andrew Gounardes and Assemblymember Deborah Glick, allowing the City much greater latitude in installing cameras, increasing the number of cameras, but still restricting them to certain hours and within ¼ mile of a school.[48] 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.[49] 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.[50]

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. The constant need to go to Albany and the inability to expand successful programs, combined with NYC DOT's tremendous success in implementing these programs, suggests 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.

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 for which New Yorkers who earn less than $86,400 per year are eligible to pay reduced fees for parking or camera-based tickets.[51] 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.[52] 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 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 license-plate-recognition-based enforcement, 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 loca-

tions 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, 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, and reserve the ability to contract with multiple vendors in order to avoid undue vendor control. 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.

5 **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).[53] 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.[54]

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 chapter 1.1. 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.[55] 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.[56]

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.[57] While the confiscation of a vehicle is a greater economic burden on someone of low income than of high income, the very high hurdle incorporated into this law suggests that the public's

interest in getting such a dangerous driver off the road outweighs any equity impact. Further, the law currently embraces a restorative justice approach, which allows a driver whose car is subject to confiscation to take a safe-driving course instead.

Questions for discussion

- If the privacy and transparency rules embraced earlier in the report are adopted, does this concept create enough benefits to be worth the data collection that it would enable?

- How do we weigh the equity downsides of cash fines with the tremendous benefits of safe and uncongested streets? Legally and practically, could the City embrace the idea of fines based on someone's ability to pay?

- License plate defacement to escape camera-based tolling is already a problem. There are unfortunately indications that some law enforcement officers have done this to their own vehicles. Are there ways to combat this?

- Some have argued that speed limiters could create safety hazards, but we have been unable to document realistic scenarios in which this would happen on city streets. Are such scenarios real? What are they? Do they outweigh the safety benefits of limiting TLC vehicles to follow speed limits?

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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 signalling 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 changes in New York City over the last twenty 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. Most bicycles were those of 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, a glance at our streets sees a much wider variety of users. Today bikes are 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 twenty years of dedicated lanes, both bikes and buses are more likely to be moving at their own speeds in their own spaces than darting through—or stuck in—general traffic.

Even more remarkable is the much wider variety of vehicles on the streets. The bikes themselves have changed dramatically—in many parts of the City, these are more likely to be bright blue shared Citibikes 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 NYC Department of Transportation (DOT) authorization, 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).[1] NYC DOT recently announced the companies that won the right to participate in an e-scooter pilot in the Bronx , which, if successful, is likely to lead to a citywide deployment that could rival Citibikes in their numbers.[2] Amazon is using cargo bikes with trailers for deliveries in Manhattan.[3] Further, New Yorkers have purchased new types of vehicles on their own—ranging from standard e-scooters to motorized skateboards to gyro-scope centered new mobility vehicles like the OneWheel.[4] 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

> **New mobility vehicles and New York City should be a match made in heaven. But it is not."**

are much smaller than traditional delivery vans.[5] In addition to Amazon's bikes-pulling-wagons, UPS has piloted an integrated cargo bike design in Seattle.[6] 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.[7] Zoox, an autonomous vehicle company recently acquired by Amazon, launched a bidirectional, small-scale vehicle designed expressly for urban applications in 2020.[8]

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.

Together with micromobility, we can call these new mobility vehicles: vehicles that are designed not for the highway, but for streets populated by pedestrians and cyclists.

For each maker of these vehicles, New York City represents the biggest and most important market in the United States. 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,

Definitions

AV: An autonomous vehicle or self-driving vehicle.

E-bike: A bicycle with a battery-powered electric motor; some are "pedal-assist," which require the rider always to pedal as well, and others can be ridden without pedaling.

E-scooter: A scooter with a battery-powered 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.

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; golf carts with speed limiters. This chapter calls for the NYC Department of Transportation to make a final determination as to what would qualify for this designation.

NYC DOT: New York City 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.

NYC Commercial Cargo Bike Pilot

Credit: NYC Department of Transportation

Amazon uses bike trailers for Amazon Prime deliveries in Manhattan.

Credit: Ben Oldenburg

Zoox Autonomous Vehicle

Credit: Zoox

Revel Electric Scooter

Credit: Revel

Nuro delivery pilot with Dominos in Houston

Credit: Dominos

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

Credit: NYC Department of Transportation

subways, and driving. Just as New York is one of the most important markets worldwide for companies like Uber and AirBnB, it's a marquee market for any company producing new vehicles designed for cities. It is always a 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 it is not. New York City has consistently lagged smaller cities in the US and around the world in embracing these new urban technologies. Bikesharing arrived in New York five years after it arrived in Montreal. E-scooters emerged in Santa Monica in 2017; it will be at least a four or five year gap before they are citywide in New York. Major-carrier cargo bikes have been in use in German cities since 2012.[9]

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 next to 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 and find their safety in their relative lack of kinetic motion. 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.[10] While this is (mostly) 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, with legitimacy.
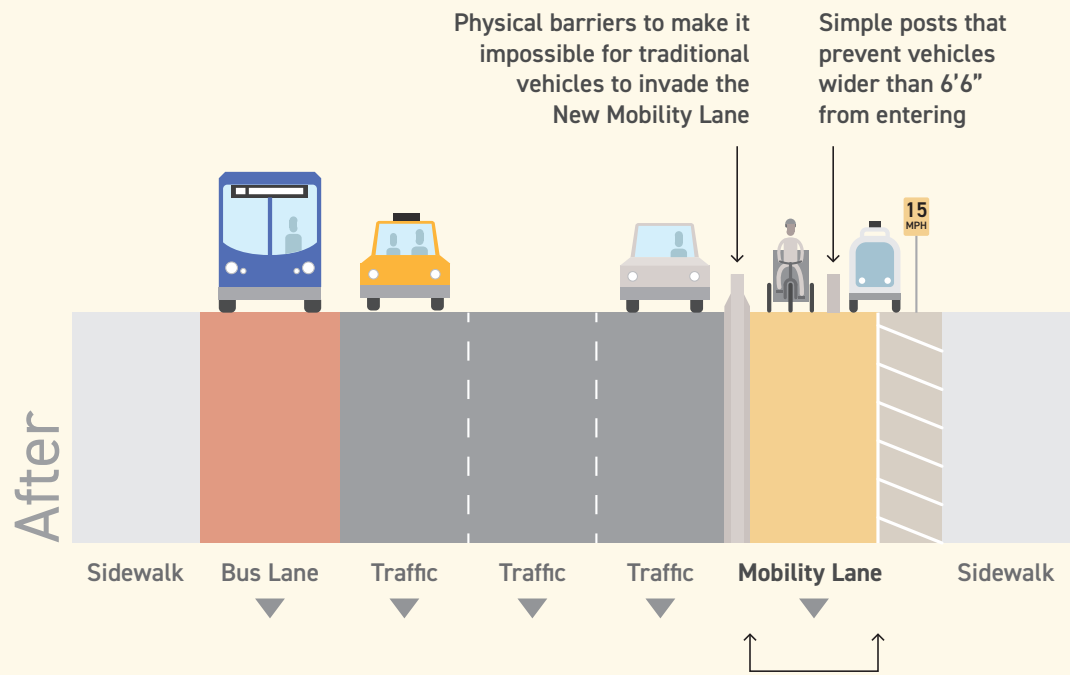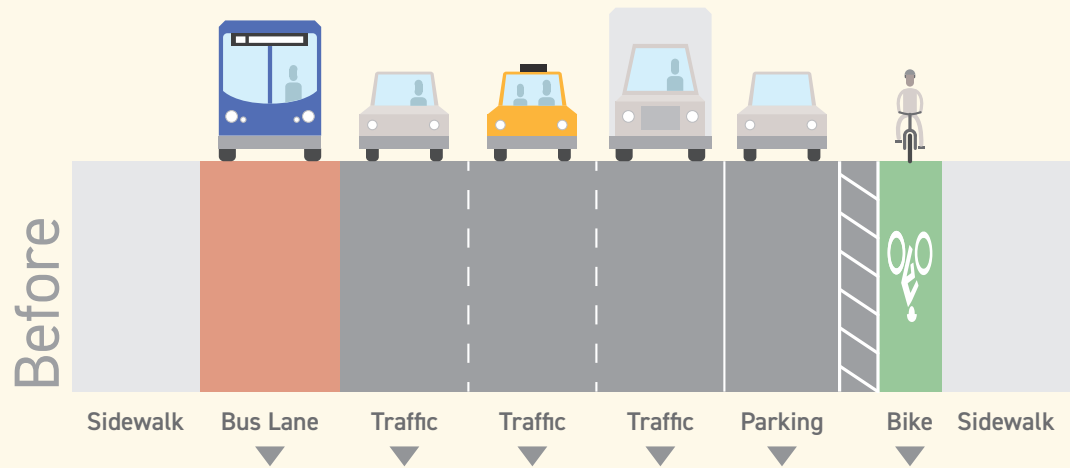
The second challenge is that New York's laws governing mobility are reactive, and rely heavily on passing legislation to enact quite narrow changes in rules that elsewhere would be delegated to regulators. This politicizes what could be more evidence-based decisions, and essentially ensures an innovation process that is disruptive,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 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.[11]

Similarly, the extent to which these rules are made by legislation leads to rules that include legislative errors, oversights, and political influences that delay the introduction of new technology. 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 year-long delay.[12] 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 and awaits new legislation in Albany to correct the error.[13] The same law banned the use of e-bikes on the Hudson River

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.

Before

| Sidewalk | Bus Lane ▼ | Traffic ▼ | Traffic ▼ | Traffic ▼ | Parking ▼ | Bike ▼ | Sidewalk |

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

15 MPH

After

| Sidewalk | Bus Lane ▼ | Traffic ▼ | Traffic ▼ | Traffic ▼ | Mobility Lane ▼ | Sidewalk |

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

Greenway, allegedly because of crowding, although no study establishing a risk was undertaken.[14] The City 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.[15]

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.[16] 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 space and greater congestion for drivers. It is also the case that many New Yorkers simply don't ever think they will 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.[17] This is a large number; but it is half the size of the number of New Yorkers who live in an auto-owning household.[18]

In short, New York City's relationship with new mobility vehicles is tortured—what should be a 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 on new urban mobility into a leader—and, in the process, help shape the vehicles of the future so they are designed to serve New Yorkers' needs. Doing this would require fixing both things that are going wrong: first, providing clear, performance-based rules stating what New York City wants to see in new vehicles, and second, providing a place for them to operate.

The first step is actually providing a place for them to operate: a comprehensive network of New Mobility Lanes. Building on the existing bike lane network and the laws and plans to expand it, the City should widen its 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, and offer more space to accommodate the increase in cycling.

Redefining bike lanes into New Mobility Lanes may also broaden the appeal of the bike lane network. 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.[19] 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 Mobility Lanes would also give New York City the ability to determine what other vehicles could use the lane. 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 they never went 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 vehicles.

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 (CBD) traffic moves at an average speed of seven miles per hour.[20] 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 are both mutually compatible and interact well with the original pro-urban vehicle: bicycles.

An agenda for the next administration

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 cross-sections and standards the network, and then applying that to all new bike lanes as they are constructed, and, as roads get resurfaced, existing bike lanes. From the four- to six-foot widths that are currently standard, DOT should adopt a ten-foot or eleven-foot standard, which 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.

A key task for the new design will be to include physical barriers to 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, physical barriers will be necessary, both on the sides and at the entrance of 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.[21]

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 as well. The actual construction of the lanes and conversion of existing bike routes will take several years, but a significant amount can be accomplished by 2025.

In 2019, the City Council enacted Local Law 195, which requires DOT to undertake two master plans — one due in December 2021 and the other due in December 2026 — that will lay out how the agency will meet certain targets intended to improve New York's streets for pedestrians, cyclists, and other users. As a result, when the next Mayor takes office, the first of these plans will already have been published. The New Mobility Lanes would therefore have to be added as an amendment to this first plan.[22]

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

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.[23] 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, some 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 another section 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.

While bike lanes are often portrayed as an elite issue, it is clear that the use of new mobility vehicles such as scooters, mopeds, and e-bikes cuts across a wide range of New York's income levels. The safety afforded users of e-mobility could well benefit low-income New Yorkers more than average, simply because the delivery persons who are often at greatest risk are low-income occupations. Encouraging a shift in delivery vehicles from large vans to small-scale cargo bikes could well result in new entry-level jobs, although the encouragement of autonomous vehicles for freight and passenger movement could lead to the loss of some jobs that currently employ low-income New Yorkers. However, the mobility benefits that these provide to all New Yorkers would likely offset the negative impacts.

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.

Questions for discussion

- How do cyclists who currently use bike lanes feel about this concept? Do they see wider lanes and greater extent as a benefit that outweighs the potential to include new vehicles into what are now supposed to be reserved for bikes?

- This chapter cites a study that says that only a quarter of New Yorkers had ridden a bike in an average year, whereas half of New Yorkers live in households with a car. Of course some who ride bikes will also have cars, which means that roughly a third of New Yorkers are neither car owners nor likely to be regular cyclists. To what extent does this proposal help address their needs?

- This concept relies on the idea that speed limiters can keep vehicles such as Revel mopeds and e-bikes to normal cycling speeds when they are in the bike lanes, and that this makes them compatible with regular, pedal-powered bicycles. Is this correct or incorrect? If we assume that the speed limiters work, is it correct?

- To what extent will new vehicle manufacturers really design vehicles based on New York City's standards? Will other cities embrace NYC-led design standards?

- Will using what are now bike lanes for a broader range of vehicles, including slow-speed autonomous vehicles serving as taxis, broaden the appeal of bike lanes beyond cyclists? Do drivers embrace the logic that shifting delivery trucks to new vehicles will benefit everyone?

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3.3 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 "expediters" 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 BIM the standard way to submit plans for review to the City. This will require new guidelines to be created, but will lead to more compliant plans, lower costs, faster construction projects, and give New York City companies an edge as the rest of the world makes this long sought-after transition.

The problem we face

As with 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 twenty years, while it has increased dramatically in most other sectors of the economy.[1]

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, but others are not—most notably, the Fire Code, which is overseen by the Fire Department (FDNY).[2] Most importantly, construction cannot proceed until a plan has been submitted to the Department of Buildings (DOB) and a permit has been issued indicating that the agency believes the plan conforms to code.

Over the last twenty 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

Definitions

AIA: American Institute of Architects

ACC (Automated Code Checking): ACC is also known as Automated Plan Review and Automated Compliance Checking.

AEC: Architecture, Engineering, & Construction (industry)

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.

DOB: Department of Buildings

ICC (International Code Council): ICC is 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.

ProCer (Professional Certification, also known as Self-Certification): The NYC Department of Buildings offers a Professional Certification Program which enables Professional Engineers (PE) and Registered Architects (RA) 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

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.[3]

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.[4]

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).[5] 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 NYC, extrapolating conservatively with the City counting as 2.5% of the US population.[6]

NYC DOB has been successful at embracing technology, but has largely done so thus far only within its own internal processes. The agency has progressed from a place in 2000 when the City's building codes were literally only available on paper, to today where the codes are available online and permit applications may be submitted electronically. This $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.[7]

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 expediters to navi-

gate the bureaucracy.[8] 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 job applications annually.[9] 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 — using a program called ProCert — that their plans conform to code. In return, DOB offers an expedited permit so long as there are no changes to the use, egress, or occupancy of the building.[10] ProCert is particularly key to keeping things moving in the field of residential renovation.[11] In 2020, 62.2% of all job filings chose this path.[12]

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.[13]

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.[14] The severity of these instances is unclear; in all likelihood, few or none directly threatened the safety of New Yorkers. However, 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 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.
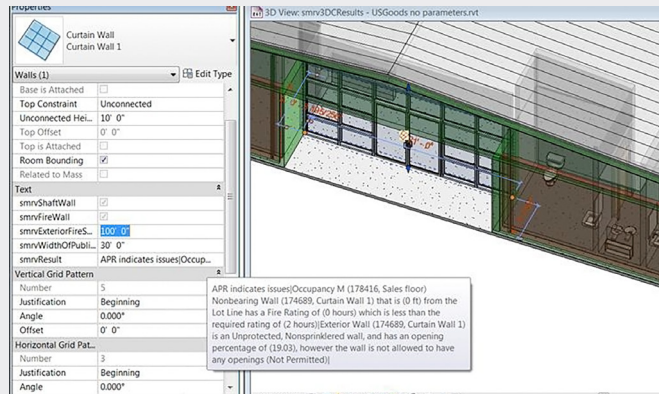
> **"** Plan review is one of DOB's most critical and labor-intensive tasks. DOB employs some 200 plan examiners, in theory to review nearly 100,000 job applications annually. In reality, however, only a portion of these are actually reviewed."

The widespread but disjointed use of CAD and BIM systems in pieces of the building and renovation design process 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 where word processors were 20 or 30 years ago: all documents were typed on a word processor, but documents were shared only 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 the age of Google Docs and Microsoft Word.[15]

Research suggests that only the government can force the industry to make such a transition.[16] While each individual player may find the necessary work-process changes to be tedious, or seemingly unnecessary for day-to-day success, these are the growing pains of a transition that must be borne 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 (BCA) successfully paved the way towards greater BIM adoption, a prerequisite for ACC. They developed CORENET, the first electronic BIM submission system, collaborated with government

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

Credit: Mark Clayton, "Automated Plan Review for Building Code Compliance Using BIM," July 2013

> ❝ 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 non-compliant aspects of a plan."

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.[17]

Meanwhile, South Korea has demonstrated the necessity of government to define 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.[18] Without 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 are in favor of this transition and have completed their own studies on automated code checking,[19] there is no single entity that will ever be in a position to shift the entire US 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.[20]
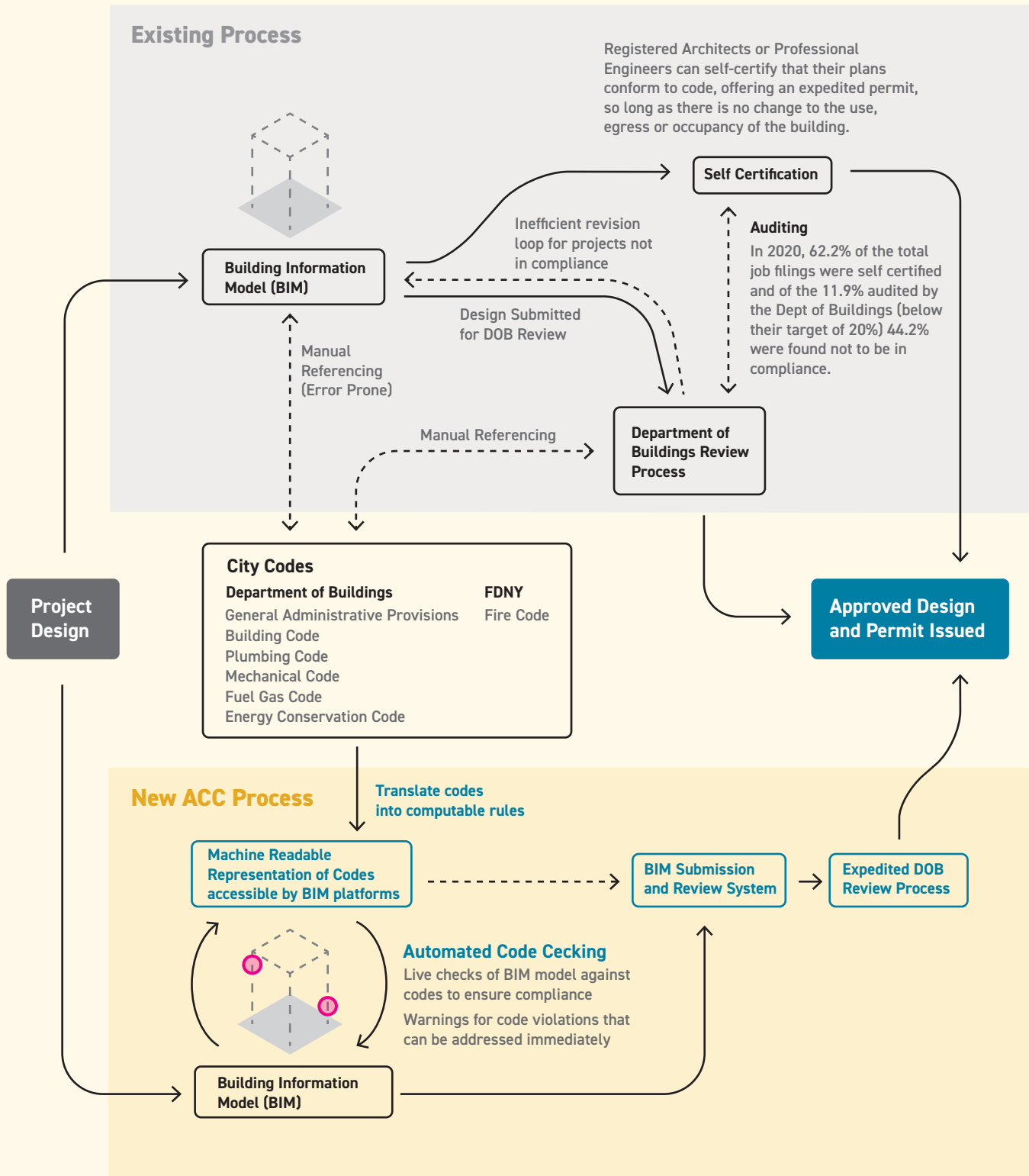
New York City's construction industry is larger than Singapore's, and its role as the nation's largest construction market means that it has the ability not only to shape its own practices, but also set the standard that other cities and states will follow. If it were to do so, it could be an advantage 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.[21] The next year, DOB published BIM guidelines for use in their Site Safety Plans Program, intended to increase safety, hasten approvals, and allow virtual tours.[22]

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 non-compliant aspects of a

Automated Code Checking Can Streamline NYC's Permitting Process

Existing Process

Registered Architects or Professional Engineers can self-certify that their plans conform to code, offering an expedited permit, so long as there is no change to the use, egress or occupancy of the building.

Self Certification

Building Information Model (BIM)

Inefficient revision loop for projects not in compliance

Design Submitted for DOB Review

Manual Referencing (Error Prone)

Auditing
In 2020, 62.2% of the total job filings were self certified and of the 11.9% audited by the Dept of Buildings (below their target of 20%) 44.2% were found not to be in compliance.

Manual Referencing

Department of Buildings Review Process

Project Design

City Codes

Department of Buildings	FDNY
General Administrative Provisions	Fire Code
Building Code	
Plumbing Code	
Mechanical Code	
Fuel Gas Code	
Energy Conservation Code	

Approved Design and Permit Issued

New ACC Process

Translate codes into computable rules

Machine Readable Representation of Codes accessible by BIM platforms

BIM Submission and Review System

Expedited DOB Review Process

Automated Code Cecking
Live checks of BIM model against codes to ensure compliance

Warnings for code violations that can be addressed immediately

Building Information Model (BIM)

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.

"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 towards a future in which all permit applications must be submitted in acceptable 3-D 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, while doing so with a clear-eyed understanding of what is feasible.

1 Enact into law a date certain—perhaps 2032—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 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.[23]

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 learning 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 the 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 Construction Industry Institute's SMART Codes.[24]

3 Begin to translate NYC'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, judgement 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 does ACABIM, and UpCodes AI, among several others.[25]

What will be necessary is 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.[26]

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.[27] 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 it correctly.[28] Thus, to resolve the steep learning curve to build up BIM expertise, NYC 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 NYSERDA'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.

Questions for discussion

- Are low-income housing renovations often delayed by the permitting process, or is capital constraint the main bottleneck?

- Would the eventual mandate of BIM overly burden smaller landlords with fewer resources to make the change? If so, how can the City reach and support those landlords?

- What are the merits and drawbacks of administering an ACC pilot before mandating BIM submissions across the industry?

- During our interviews, an adjacent issue that arose was the byzantine nature of navigating City agencies for a homeowner's renovation. To what extent should the City prioritize streamlining the user experience when interfacing with agencies?

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3.4 Reduce 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 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 make drone inspections more frequent and physical inspections less frequent, 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, the law was updated in 1998 and now mandates that all buildings over six stories undergo a physical facade inspection every five years.[1] 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.[2] Of the approximately 1 million buildings in NYC, more than 14,000 are over six stories and therefore covered under FISP.[3]

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

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, and reduce retail sales in storefronts underneath scaffolding.[6] 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.[7] 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.[8] 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.[9] Seeking to reduce this duration, DOB imposed a

> " Sidewalk sheds severely diminish the quality of public spaces, and reduce retail sales in storefronts underneath scaffolding. "

Scaffolding (left) vs. sidewalk sheds (rigth)

Credit: Clay LeConey, Zachary Shakked

Definitions

DOB: Department of Buildings

FAA: Federal Aviation Administration

FISP: Facade Inspection Safety Program, formerly known as (and used interchangeably with) "Local Law 11" (LL11)

SWARMP: Safe with a Repair and Maintenance Program. Buildings' conditions are classified as Safe, Unsafe, or SWARMP (middle ground).

UAS: Unmanned Aircraft System, aka drones

QEWI: Qualified Exterior Wall Inspector (can be a NY state licensed Professional Engineer or Registered Architect)

Sidewalk sheds vs. Scaffolds: often used interchangeably, there is a distinction: a sidewalk shed is meant to protect pedestrians from falling debris, whereas a scaffold is a work platform used to ascend and make repairs, usually erected on top of a sidewalk shed.

new rule in 2020 to require that building owners correct unsafe conditions within 90 days.[10] 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 — small, unmanned aerial vehicles — are increasingly being used for infrastructure inspections, among many other applications.[11] 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 detailed, close-up visual inspection of a building facades. Because drones can fly in precise formation, they can piece together a perfect, high-resolution image of an entire building at close range, and thus eliminate the need for human inspectors to climb scaffolding or rappel down a facade. 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.[12] This software already exists and is widely used for inspections of bridges, construction sites, industrial plants, and other infrastructure.[13]

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 (IRT) can detect heat signatures that may be indicative of compromised structural elements, and Forward Looking Infrared Radar (FLIR) can identify minute gas leaks.[14]

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.[15] If drone inspections could discern buildings with no risks, it 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%.[16] 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 a physical inspection, especially for tall buildings. Short buildings are already relatively inexpensive to inspect, estimated at $10,000.[17] But the inspection of taller buildings can run upwards of $100,000 using traditional scaffolding. With drones, however, one firm estimated that a six-story building could be inspected at a 30% cost reduction.[18]

The promise of drone inspections led the City Council to enact Local Law 102 of 2020, which mandates that DOB study their potential for facade inspections to be conducted by drone.[19] The study is currently ongoing, and is due to be issued no later than October 31, 2021.

There have been two concerns raised about using drones for facade inspections that are expected to be a focus of that study. The first is the general concern about the use of drones in New York City. Technically, drones are currently banned citywide. A 1948 law[20] and Administrative Code §10-126[c][21] prohibits aircrafts from taking off and landing anywhere that isn't designated by the City's Department of Transportation or the Port Authority, like airports and heliports, in spite of the Federal Aviation Administration's (FAA) 2016 rule[22] that legalized commercial drone use.[23] This is due to the risk of drones potentially causing damage (intentionally or unintentionally), colliding with other aircrafts, or harming people on the City's crowded sidewalks.[24] Further, the 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 negligently. While the FAA is working on rules that would help clarify this situation,[25] 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.[26]

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.

Fault detection software can then flag any deviations from the 3D model that the drones developed, resulting in quicker visual inspections of facades and faster repairs.

Credit: Helios Visions / heliosvisions.com

Drones can use thermal imaging to detect heat signatures that may be indicative of compromised structural elements.
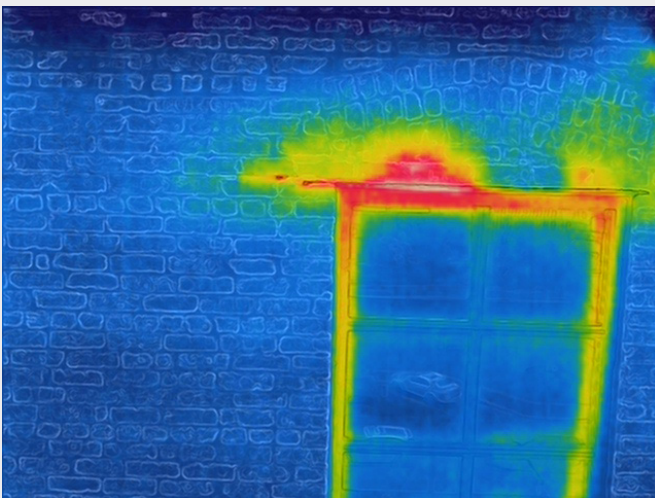
Credit: Helios Visions / heliosvisions.com

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."[27]

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 potentially 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

Building on the drone report that DOB is working on, the next Mayor should undertake a significant 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:

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

Sidewalk Sheds

Of the ~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.
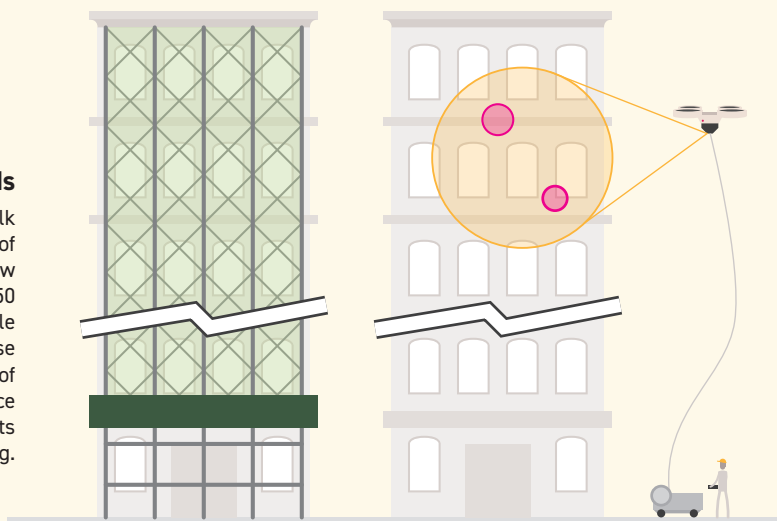
Drone Imaging

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.

❝ 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.❞

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 Department of Buildings, 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.[28] 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.[29] Second, building owners could be required to notify residents of the timeframe 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, 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.

Questions for discussion

- Does the objective of reducing sidewalk sheds by 15-20% seem worth the work and taxpayer investment it will take to realize this innovation?

- Are there any equity concerns with this concept that we should consider?

- Are the privacy considerations described here sufficient?

- Do tethered drones sound like a worthwhile solution to the security challenge of free-flying drones in the skies of New York City?

- One of the underlying reasons for long duration of scaffolding is the expensive nature of repairs — it's cheaper to rent scaffolding. As a result, cash-strapped smaller landlords with older buildings end up dragging their feet on making repairs. How can the private sector assist in solving the financing problem?

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3.5 Additional concepts under consideration

The problem of electrifying buildings

It is clear that the future of buildings requires a greater reliance on electricity. Reducing greenhouse gas emissions requires electrifying heating and cooling systems. And, 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 to electricity. 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 multi-family 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.

Questions for discussion

- How much of an issue is this? Are New Yorkers who live in apartment buildings without doormen simply finding other ways to get their packages? Delivery companies are developing creative solutions such as paying fees to local retailers to receive packages for neighbors. Is this a problem that does not require

- Is the on-demand economy useful to low-income New Yorkers? Or is the conventional wisdom that it is mainly a luxury more correct?

- If it is a problem that the city should address, do any of the potential solutions seem more promising than the others? Or are there other potential solutions we have not identified yet?

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 range from making it possible for New Yorkers to ask one City agency to share personal data with another agency, and keeping Community Board meetings virtual to expand participation. These are just the beginning: technology also offers new ways for the City to be 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 data locker and interagency verifications

Millions of New Yorkers need social services from the City, ranging from direct financial assistance for senior citizens to public education for children. These interactions between the public and the city agencies should be seamless, 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 needed 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 experiencing hardship maintain economic security. Supplemental Nutrition Assistance Program (SNAP), the most widely used benefit administered by NYC Human Resources Administration (HRA), supported 1 in 5 New York City residents in January 2021.[1] In addition to SNAP, New Yorkers qualify for and/or receive dozens of other benefits, which range from housing adjustments, to direct cash transfers, to childcare—or even public education for their children, which we generally don't consider "public assistance" but which is, essentially, a qualified benefit.[2]

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 NYC 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.

The de Blasio administration has made significant progress in using technology to make the process of finding, and applying for these benefits, easier. In 2017, NYC Opportunity relaunched ACCESS NYC, updating a website first launched in 2006 under Mayor Michael R. Bloomberg and making it mobile-friendly, which is crucial 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 new, also mobile-friendly website and app where New Yorkers can apply for SNAP, Cash Assistance (CA),[3] 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.[4]

> **"** 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"

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.[5] Applications for Cash Assistance (CA), only became available in a digital format in March 2020 and 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.[6]

Despite these successes, however, navigating the City's benefits is still a difficult task.

First, the documentation that proves one is eligible 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.[7,8] 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.[9,10] Advocates also report that applicant documentation is often lost after submission; the Urban Justice Center reported that 25% of SNAP and 50% of Cash Assistance applicants interviewed said that case workers had lost their paperwork.[11] This high number of

rejected cases not only delays the receipt of benefits for qualified applicants who may need to reapply, but also creates extra work for caseworkers.

Second, while ACCESS NYC helps applicants identify what they might be eligible for, it then passes them off to separate agency websites that all look and feel entirely different. Each agency has different documentation requirements and application processes—and even when their requirements are similar, the radically different user interfaces can easily lead an applicant into confusion. Clients are required to navigate to different platforms, learn new interfaces, and re-enter their information to apply for and manage the programs they are entitled to. This creates a huge burden of repetition: one report concludes that to apply for a basic set of benefits—SNAP, Cash Assistance, Section 8, WIC, and Federal, State, and City Earned Income Tax Credits—required 12 pieces of documentation, 5 of which needed to be submitted at least 7 times."[12]

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 like 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 (DOHMH) has their birth certificate; for a public school student, the Department of Education has all of their vital records, including where they live, who their parents are, and whether they have received their vaccines.[13] If they were married in New York, the City Clerk has their marriage certificate. For any of these, the originals are effectively stored in the computers of City agencies—so

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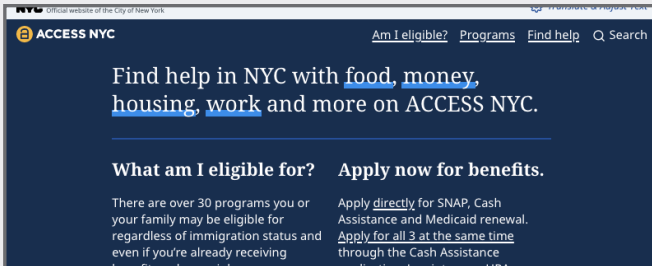
ACCESS NYC

Agency | NYC Opportunity

Program | Eligibility screener
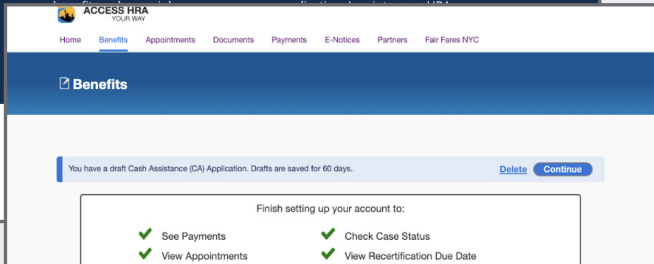
ACCESS HRA

Agency | NYC HRA

Program | SNAP, CA, Medicaid, One Shot Deal, Fair Fares
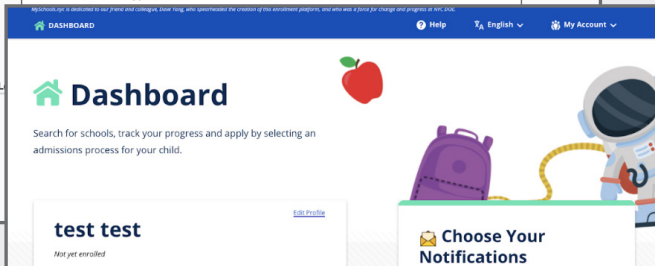
My Schools

Agency | NYC DOE

Program | EarlyLearn

PDF Application

Agency | NYC DOF

Program | DRIE

NYCHA Self Service Portal

Agency | NYCHA

Program | Section 8

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; and it should not require additional fees or documentation requests to make happen.
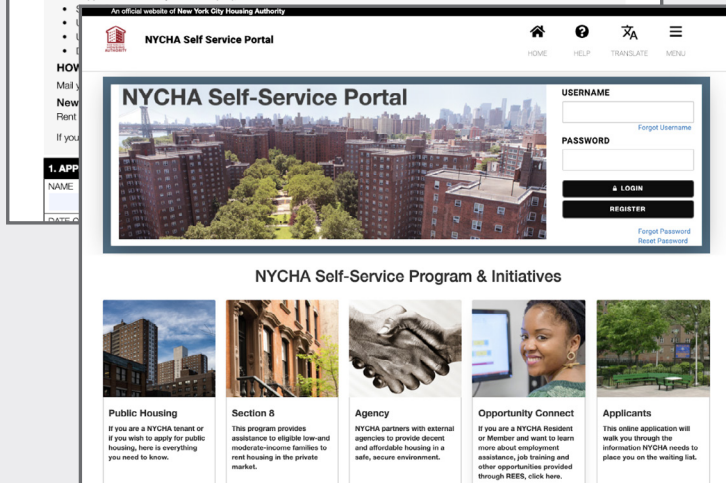
Similarly, it should be possible to create a "data locker" that can upload and store third party records. Many providers—such as banks and hospitals—have established consent frameworks that allow individuals to authorize others to access certain data for specified purposes and an entire industry has 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.[14]

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. Alternatively, 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 the user's control over their data, the individual would still need to authorize agencies to access each document as needed for their application. But this kind of check-box approach would be far simpler than obtaining, photographing, and uploading paper documents as is generally required today.[15]

NYC Opportunity is already working on a pilot that tests this very concept. Over the last two years, NYC Opportunity in partnership with New America Foundation and the NYC Office of Homeless Services developed a Digital Data Locker solution to facilitate more

efficient sharing of core documents required in benefits applications between clients and case workers. 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 to incorporate feedback from users, practitioners, and researchers. Other cities are also experimenting with this technology. On March 9, 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.[16]

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 pre-qualification 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.[17]

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; but improving the experience for New Yorkers will also require standardization across these other aspects of agency processes.[18]

An agenda for the next administration

The next Mayor should move aggressively to build on the successful work of NYC Opportunity and HRA and make 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.

> **The ability to have a record sent upon request, from one City agency to another, is a challenge that technology can easily help solve; and it should not require additional fees or documentation requests to make it happen."**

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, and 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 be able 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 in need of social services complete their applications with ease, the concept can be expanded to cover all New Yorkers who have interactions with the City, whether as taxpayers, individuals to place requests with 311, or in any other setting where they need to complete 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 this report, and builds on a recommendation from the City's 2018 report which recommended consideration of a "Digital Application Service" to serve as a central resource to provide support and design tools to help agencies move from paper or web enabled forms to online applications.[19] As 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 the 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 may need to enact a mandate that this work be undertaken, 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 consid-

eration 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 who is 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 are fundamentally to 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 "Broadband" (chapter 2.1). 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 call 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.

Questions for discussion

- Does the proposal of a data locker address an important issue? Have we misunderstood the challenges facing applicants for benefits?

- How difficult would it be to create the data locker? Have we underestimated its complexity?

- How could internet security services, such as Okta, be used to ensure privacy and prevent unauthorized access to data in the locker?

- Are there other problems related to social service delivery that a technology might solve?

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4.2 Make Community Boards more representative by keeping meetings virtual

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 have converted to virtual meetings, and generally have seen participation increase as the barrier of physically attending a meeting has decreased. We recommend not only that Community Boards continue meeting virtually, but also that they make use of additional features of online meetings, such as automatic closed-captioning, computerized translation into multiple languages, and alerts for when specific topics are discussed. Taken together, these 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 City, this often takes place in a meeting of one of the City's 59 Community Boards, which serve as the City's most local form of government. 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.[1] 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.[2] The Community Board members themselves are generally not representative, with membership that is generally whiter, older, and more male than the populations they represent—tendencies that are true in most of the Community Boards across the city.[3] In part, this stems from existing patterns of political connectedness, but this disconnect also stems from the simple fact that full participation in a Community Board requires a significant time investment preparing for and attending weekday evening meetings, a total commitment of about ten hours a month.

As a result, the members of the public who participate in meetings on occasion are important to ensuring that Community Board decisions reflect the diversity of perspectives in the neighborhood. However, attendance at Community Board meetings has in part been biased

by the fact that they are in-person meetings that generally take place in the evenings. Barriers to access leave some New Yorkers unable to attend, whether these are accessibility challenges to participating in venues without assistive infrastructure for certain disabilities, the City's many inaccessible transit routes, or a lack of hearing loop technology. For others, the addition of travel time, caregiving duties, or evening work hours create even more barriers to participation. As a result, Community Board deliberations often represent the perspectives of people with high levels of awareness, free time, and special interests who are likely to attend in-person meetings at disproportionately higher rates. This has prompted increased criticism of the Community Board as an institution, and calls for City agencies to give Community Boards less influence in their decision making.[4]

Significantly, the shift to online meetings forced by the pandemic has expanded participation in Community Boards. 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.[5] After years of advocacy by accessibility and transparency advocates alike, remote participation became the standard instead of the exception almost overnight.

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 City Community Boards in their transition online. "There were a few contentious Community Board meetings where there were over 1,000 people in attendance."[6]

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, thirteen of the fourteen Community Boards reported that virtual meetings have increased or greatly increased public turnout and engagement at their meetings.[7] One noted that "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

> "Community Board meetings and other public meetings hosted by government agencies are often unrepresentative of their neighborhoods"

pointed out that "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."[8] Manhattan Community Board 6 (CB6) 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.[9] 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 Board reported that members of the public also regularly cross-syndicate the Board Meeting videos to Facebook, where they gain further viewership.

Despite this success, the sudden shift to virtual meetings is 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 this report (see chapter 2.1), 18 percent of New Yorkers lack any internet connection at home, and 29 percent do not have broadband access at home.[10] 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. Further, online meetings present new challenges, as well as issues inherent with technology, including cybersecurity[11] and privacy concerns and the chronic digital divide in the city.

Further, shifting to successful online meetings required significant effort from administrators and participants, facilitated by advocates and nonprofits.[12] 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.[13] 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.[14]

The technology opportunity

Despite the fact that they raise different challenges of ensuring equal access to Community Board meetings, virtual meetings also offer additional tools, as yet untapped, to draw in more New Yorkers.

The first of these is automated transcription. The machine learning (ML) 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; realtime 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 advances in machine learning have greatly improved free, automated translation services just as they have speech recognition. Given New York's multilingual

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

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 more detailed records than are generally kept, and 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 thousands of users across all five boroughs: "A significant portion were daily active. 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."[15]

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 the name of their child's school, the street they live on, their park or bike lane, or a business they either patronize 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 is already a priority of the de Blasio administration, and is receiving significant attention in Albany and Washington. We cover the topic in "Broadband" (Chapter 2.1).

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. By extending the option to virtually attend public meet-

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.

transcript generation process

Get Transcript → **Format** Text → **Generate** Summary → **Share** Meeting
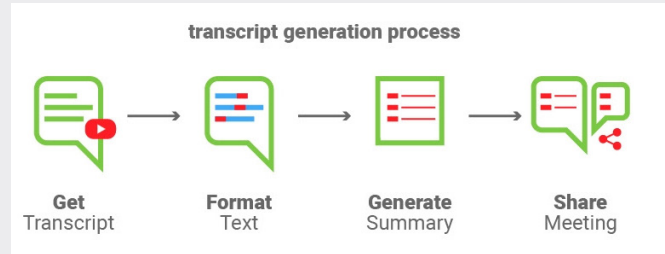
Credit: Block Party

ings, 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. 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 online 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.

1 **Advocate for Albany to amend the Open Meetings Law to allow continued virtual 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.[16] The current ability of Community Boards and other entities to hold virtual meetings derives from Governor Andrew Cuomo's Executive Order 202.1,

which granted the ability to hold remote public meetings, justified by the state of emergency created by the pandemic.[17] Public officials such as Manhattan Borough President Gale Brewer and Queens District Attorney Melinda Katz have been leading this cause to date.

The Public Officers Law needs to be amended so that voting members attending virtually will count towards quorum and be able to vote. 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).

The next administration should also ensure City-wide compliance with Local Law 103 (known as "the webcasting law").[18] Sponsored by then-Councilmember 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," stream the meetings online.[19] 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, responsible for driving compliance with Local Law 103, and by providing the requisite technology through DoITT or another agency (rather than providing funding, which can 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 virtual meetings, as well as distributed locations where New Yorkers without broadband access can attend.

One key challenge with the transition to virtual meetings has been 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 twelve Community Boards in the borough, at the cost of close to $1,500 per district.[20] Others, such as those in Brooklyn, were left to fund and procure virtual meeting technology licenses on their own.[21] 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[22] makes it more difficult for training partners, as well as Community Board staff, not to mention members of the public, to navigate as they attempt to participate. 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 when you want to meet the concept of a hybrid meeting."[23]

As a result, 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 be provided at better rates and with less administrative overhead. Uniform tools and standards also make training easier for both administrators and users.

One important component of a user-centered webcasting kit will be to 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.

What will it take to keep live streaming 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 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 meeting best practices, including privacy and cybersecurity needs

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A user orientation in the selection and implementation of the webcasting kit may well determine the success or failure of virtual meetings.

3 ## 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,* NYC'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 the Community Board's Secretary to review the draft transcript in a timely manner, and the District Managers to ensure that it is uploaded.

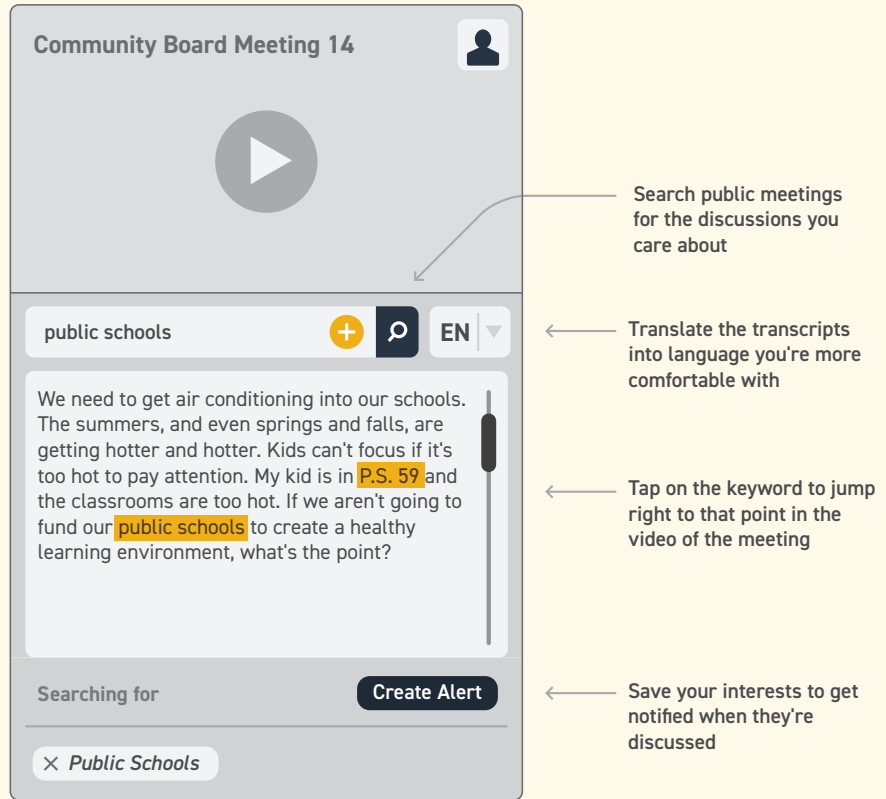Speech-to-text transcription of public meetings also opens the possibility of interactive transcripts. This growing field of multimedia software allows additional creative interoperability with the words spoken in meetings. People can search a meeting recording with a text query, as they would when using a 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 writing 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 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.[24] (For context, human-transcribed texts cost over $50 per hour.)[25] Although YouTube provides captions for free, it only does so 24 hours following a video stream, which is insufficient to achieve this vision.

Live transcripts of public meetings

A mock-up of how keyword search of video transcripts could work, powering personalized alerts and other accessibility features.

Community Board Meeting 14

▶

public schools ➕ 🔍 EN ▼

We need to get air conditioning into our schools. The summers, and even springs and falls, are getting hotter and hotter. Kids can't focus if it's too hot to pay attention. My kid is in P.S. 59 and the classrooms are too hot. If we aren't going to fund our public schools to create a healthy learning environment, what's the point?

Searching for   **Create Alert**

✕ *Public Schools*

Search public meetings for the discussions you care about

Translate the transcripts into language you're more comfortable with

Tap on the keyword to jump right to that point in the video of the meeting

Save your interests to get notified when they're discussed

Additional features could be added to the webcasting kit, especially if it is designed and delivered through local, effective 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.

4 Create an interest-based alerts 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 eight years there has been no movement on this topic.[26] By making it significantly easier for New Yorkers to pay attention to the topics that interest them, we can expect significantly greater involvement.

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 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.

> ❝ Digital government should have a ubiquitous and unified user interface❞
>
> — **Noel Hidalgo**, BetaNYC Executive Director

Implementing such a system will require a focused effort, but should not be a major investment either of 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 effort 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.

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 CB 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 CB 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.

Block Party's automatic keyword classifier demonstrates how often certain topics come up in a given meeting.
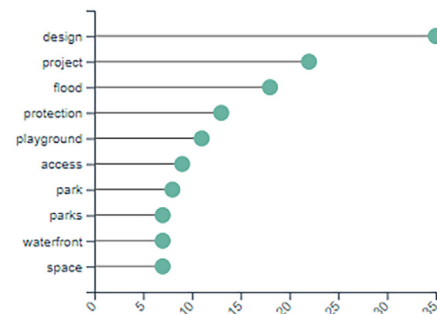

Credit: Block Party

Questions for discussion

- Is the impression that virtual CB meetings have gone well widely shared?

- This section essentially argues that the interpersonal relationships among CB members — which are clearly fostered more by in-person meetings — are less important than broader community participation. Is this a wise trade-off? Are there benefits of in-person meetings that this section is undervaluing?

- Would automatic transcriptions and translations be useful? Who would use such features?

- Would the automatic alert feature be useful? To whom?

- As mentioned in the "equity concerns" section above, we believe this set of proposals improves equity, but we do not have sufficient data to prove it. Does such data exist for a CB that we have thus far not yet contacted? Does the overall belief that broader participation and translation services makes this an overall improvement to equity?

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4.3 Additional concepts under consideration

The problem of accountability

The Mayor's Management Report (MMR) is a document that presents statistics on the performance of each city agency across a number of indicators. Started in 1979 by Mayor Ed Koch, it is now mandated by the City Charter.[1] Issued twice per year, the paper report runs to 339 pages, although 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 more real-time data that track even more important indicators than those in the MMR. Further, the success of Open Data, in which New York City was a leader, means that extensive datasets are updated regularly allowing those with the interest and skills to use them a far more detailed, and often more relevant, understanding of the performance of City agencies. 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 datasets available on NYC Open Data.

- Do nothing, as the current system is resource intensive but is not causing harm.

Questions for discussion

- Is the publication of open data — relying on the press and others to analyze it — sufficient to hold agencies accountable for performance?

- What types of data that are not on NYC Open Data would be needed for it to be a complete replacement for the MMR?

- Are there examples of a truly excellent dashboard allowing real-time or near-real-time insight into the performance of an entity as complex as the City?

- Is this something that does not need fixing because it's not really broken?

The problem of multi-channel interaction with the City

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.[2] Each month, 5.4 million unique visitors used nyc.gov.[3] 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 further improvements.[4] Many agencies have invested significantly in digitizing permitting and application

processes. The Public Engagement Unit, 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.[5] 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.[6] Taken together, New York City has done an admirable job of creating multiple channels through which to engage with residents.

At the same time, our research indicated 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 their bank, airline, or insurance company. 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 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.

The result is a fragmented resident experience. A recent forum by Columbia University identified 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."[7] In short, New Yorkers have a far more seamless experience interacting with their bank or insurance company than to do with their city government.

Potential solutions:

- Reinvent 311 and nyc.gov entirely, replacing them with a unified multi-channel 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.

Questions for discussion:

- Is a full reinvention of nyc.gov necessary in order to bring it up to the standards of customer expectations in 2021? Or are incremental improvements sufficient?

- Is it fair for New Yorkers to expect a level of integrated customer service from the City that they expect from a bank or an airline? Or should expectations be different because it is a government and not a business?

- Is inter-agency account integration a good idea or a bad idea? Would the kind of changes it require in turn require a wholesale shift away from legacy computer systems? Would that shift be a good thing or a bad thing?

- If a single login credential were created, would two-factor authentication be sufficient to make it secure?

The problem of ensuring those who do not use digital channels are not left behind

One risk that has held back the embrace of digital platforms for public engagement is that they risk serving those who already enjoy power and privilege. There is a reasonable fear that the more integrated — and better — the City's digital services become, the greater a gap exists for those New Yorkers who cannot, or prefer not to, engage digitally.[8]

The de Blasio Administration sought to address this gap with the 2015 creation of the NYC Public Engagement Unit (PEU), which brings the outreach tactics and spirit of campaign organizing inside of city government. PEU contacts New Yorkers by phone, at home, and increasingly, through digital channels like peer-to-peer SMS to proactively help them enroll in healthcare, procure municipal ID cards, and participate in other city programs that help ensure healthy, happy lives. The PEU teams provide residents support with initial applications as well as long-term case management

to help them resolve issues they face interacting with government agencies in housing, health, and other critical service areas. As a cross-cutting resource spanning the city's many individual departments, the 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.

While PEU has been successful in many ways, our conversations indicated an opportunity to use PEU more strategically as a complement to a greater digitization of City services. PEU's location within the Human Resources Administration (HRA) has limited its scope and utilization compared to the broad range of needs that a data-driven team using interpersonal outreach could serve. Further, the unit has been understaffed compared to its budgeted headcount.

Potential solutions

- Move PEU into the unit to be overseen by a Deputy Mayor for Technology, and integrate its activities with 311 and nyc.gov, making PEU a complementary channel targeted at those New Yorkers

- Fully fund and staff PEU but leave it within HRA, either asking it to act in coordination with 311 and nyc.gov

- Leave PEU within HRA but establish a similar, parallel team tightly integrated with 311 and nyc.gov

Questions for discussion

- How much of an issue is it to expand digital services without considering the needs of those who do not use technology?

- To what extent is technology training a better solution than offline outreach? To what extent are they mutually beneficial, or should the strategy focus on one rather than the other?

- What are the benefits associated with PEU's location within HRA?

- Would PEU's current mission be boosted or curtailed by a close coordination with 311 and nyc.gov?

The problem of digitizing democracy

Nyc.gov and 311 generally address residents as consumers, but 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 monies appropriated through PB have been the small amounts ($1 million) allocated to councilmembers' discretion for their own district projects, and second, managing the PB process has been a burden placed on the councilmember's staff.[9] 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.[10]

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, including municipalities in France, Japan, and Finland, is a platform that directly connects residents with the tools of government, such as collaborative proposal drafting tools 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.[11] 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, of which nearly 15% of the public's ideas were accepted into the City's budget.[12] 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.[13] 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.[14]

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.[15]

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

Questions for discussion

- Is Participatory Budgeting worth expanding? If not, should it be halted, despite the 2018 referendum?

- Are the downsides to using a tool like Decidim prior to City Council or Community Board votes?

- To what extent can Decidim be gamed or hacked in ways that might make it less representative than elections?

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5 Futureproofing: Position NYC to shape the urban technology of the future

From mobile phones to AirBnB, and from LinkNYC to Citibike, new technology has changed New York City dramatically over the last twenty years. With 5G technology on the horizon,the pace of change in cities will only accelerate further. Whether in new innovations like autonomous vehicles, new social media platforms, or machine learning managing buildings, it's a safe bet that new urban technology will affect New York City as much over the next twenty years as it has over the last twenty years.

New York City has not done an excellent job of getting ahead of new technology and the businesses that employ them. It must learn to do so.

New Yorkers need to be in a position to shape how urban technology arrives in their city: not to be the target of a corporate expansion strategy, but to be 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 cities as a whole, and 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, which 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.

Definitions

DOT: NYC Department of Transportation

ADS (Automated decision systems): any system that uses data, algorithms, or artificial intelligence to make recommendations or decisions.

TLC: Taxi and Limousine Commission

NPCC: New York City Panel on Climate Change

ETAP: Emerging Technology Advisory Panel (proposed in this chapter)

The problem we face

The last decade has seen technology transform many aspects of life in New York City. Ride-hail companies like Uber and Lyft have changed transportation patterns. AirBnB has changed the way people visit the City and changed the residential market and hotel industries. E-commerce has changed retail economics. Digital advertising screens and Citibike 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" shaped by their own business interests rather than being harnessed to improve urban life. The subsequent battles around what rules should govern them therefore were 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 multi-year 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 who 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. And, even then, it did so coarsely and in a way that invited losses in court.[1]

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 was inescapable, did the politics change, and then the City was able to impose regulations that were perceived as severe. In part, however, that was transparently driven by a desire to please vocal incumbents rather than New Yorkers in general.[2] Then, the City lost an important court case that will stymie its ability to regulate AirBnB to the full effect of the law. Although the COVID-19 pandemic has put this struggle to the side, it will almost certainly flare up again when travel resumes.

Facial recognition technology is currently on the same path. While facial recognition is today a widely-understood technology, it was not publicly recognized as a significant technology when the NYPD 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 with people with darker skin; its use by landlords and others engaged in practices that violate contextual privacy standards; and questions about who has knowledge of what searches have actually been run. As a result, New York is now banning the technology's use. In contrast, the state of Massachusetts has developed procedures around the use of facial recognition that seek to make use of the technology for appropriate reasons, by specific personnel, and to rely on its results only to the extent that they can be verified.[3] 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 taken the opposite tack. While Bird, Lime, and other e-scooter companies proliferated 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 fear of experiencing again what Uber and AirBnB had done.[4] As of April 2021, NYC DOT has only now approved an initial, highly controlled, pilot deployment of e-scooters in one section of the Bronx. While such an approach will certainly manage the risk of negative impacts, it will also ensure that full-scale deployment across New York City will lag more than five years after scooters became available in many other cities.[5]

These tortured interactions are 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, City officials have cited the fact that rules for identification and flights in urban areas are under development by the Federal Aviation Administration (FAA). 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 tools the City uses to make decisions that might incorporate bias. But the task force met only a few times and issued a report written by City Hall staff that was widely panned by its members, some of whom argued it reflected only the perspective of the mayoral agency that chaired and staffed it.[6]

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.[7] 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 have tended to regulate very specific uses of technology, as in the case of a recent law regulating retailers' use of facial recognition.[8]

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. Uber and Lyft's national strategy 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 (TLC) regulation of for-hire vehicles.[9] 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.[10] In the absence of thoughtful city-level regulation, the arguments of new entrants will sound stronger in the State Legislature.

The technology opportunity

If all of this were in the past — if urban technology were now stable — this might not require action. But urban technology continues to evolve. Autonomous vehicles are in revenue service in the United States. Drones are already being used in New York City, even if illegally; sidewalk robots are already in use; and new technologies are reshaping consumer purchases and urban planning. Failing to fix this process will condemn New York to repeat the missteps of the last decade of urban technology.[11]

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; its media attention means that a New York launch is one of the most

The even greater risk is that New York City will continue to miss its potential to shape the way urban technology evolves."

closely-watched stages in any tech business's evolution. Thus, 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 a message that an innovative company can work with; but a message that says, "here's what we need to see from you, and then we're eager to be helpful" will obtain cooperation.

The challenge is that neither City agencies, nor the Mayor's office, nor the City Council is 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 these have not gone so far as to include actually writing regulations in advance.[12] 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.[13] 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.[14]

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, the producers of green technology, 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.[15]

While the GCTF focused on changes needed immediately, the challenge of planning for long-term impacts of climate change required a different approach. The forecasting of 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' 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 perpetuated 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 NYPCC is tasked with writing a report every two years that summarizes what the latest research says climate change will mean for New York, and identifies implications for the City as a whole, and for City policies. The NYPCC is self-gov-

erning insofar as no City agency chairs its meetings or reviews its findings. Its last report was published by the New York Academy of Sciences.[16]

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 an accelerated process to develop regulatory guidance to address emerging technologies and their impact on the city

With drones, sidewalk robots, automated decision-making systems, facial recognition, and autonomous vehicles already in use here and elsewhere, New York City is already late to creating rules and regulations governing their use, and signalling 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 reasonably impartial, 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 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 given priority, 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, it may be necessary for the City Council to enact a broad, temporary prohibition on the technologies to be covered, until a date certain (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 in fact already here, there are inevitably going to be technologies that will 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 rationally 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 recommendations. If implemented, the rules created through these two recommendations 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.

Questions for discussion

- The technology industry has long argued that regulation in advance of new technology stifles innovation. This chapter argues that regulation can both shape new technology to enhance public benefits, and facilitate its introduction by making it less controversial. Is this perspective correct? What downsides are there to regulation in advance of new technology?

- Are there other ways that New York City could develop a strong perspective on emerging technology without relying on outside entities? Is this chapter undervaluing the ability of City agencies and Council staff to accomplish this?

- This chapter disagrees with the perspective taken by some City agencies that it is better to wait for Federal and State laws and rules because they would preempt City rules anyway. What are the arguments for that perspective? Is it more persuasive than the activist perspective taken here?

- Are all the facts in this chapter accurate?

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This project was initiated and led by Rohit T. Aggarwala.
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Victoria M. Woo led our work on privacy. Rebecca Lassman
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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.

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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. Prior, Phillip was a non-traditional 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 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.

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Conflict of interest disclosures

Rohit T. Aggarwala has an indirect financial interest in Coord, a company mentioned in this report.

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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.

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Summary of recommendations

Recommendations	Rationale	Initiatives	Responsibility
1. Foundations: Privacy and administration			
1.1 Enact a law regulating how City agencies and private entities gather and share data from the public realm	*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 privacy invasions.*	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**
1.2 Make the City an effective purchaser, developer and manager of technology projects	*The City is not as well organized or staffed as it should be to purchase and manage technology well*	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, Comptroller**
		Break up DoITT and place its components and other technology agencies under a new Deputy Mayor for Technology	**Mayor, City Council**
		Conduct a broad inventory of the City's technology, and update it regularly	**Mayor**
1.3 Additional concepts under consideration	*Many New Yorkers are concerned that NYPD's surveillance technology has evolved without sufficient oversight*	Address the problem of evaluating and regulating police technology	**tbd**
2. Technology equity: Include everyone in the digital economy			
2.1 Create a Broadband Development Corporation to bring the internet to all New Yorkers	*Too many New Yorkers lack access to broadband internet*	Establish a Broadband Development Corporation tasked with the creation of a citywide open-access fiber network and utility corridor network	**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 including broadband questions in the Housing and Vacancy Survey	**City Council, Mayor**
2.2 Additional concepts under consideration	*Too many New Yorkers do not have a bank account and thus cannot participate in online transactions*	Address the problem of electronic payments	**tbd**
	Too many New Yorkers have difficulty receiving deliveries	Address the problem of package deliveries	**tbd**

Recommendations	Rationale	Initiatives	Responsibility

3. Optimized systems: Use technology to improve the management of our built environment

Recommendations	Rationale	Initiatives	Responsibility
3.1 Bring safety and order to our streets through digital management and enforcement	*Our streets and curbs are too dangerous and disorderly because traditional management and enforcement practices are ineffective*	Build out a complete network of enforcement cameras immediately, and use them to the fullest extent of City authority, including data-gathering and TLC enforcement	**Mayor**
		Obtain authority from the State Legislature 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**
		Implement a curbside management system allowing parking reservations	**Mayor, City Council**
		Explore requiring speed limiters on TLC-licensed vehicles	**Mayor (TLC)**
3.2 Convert and expand bike lanes into a network that accommodates a variety of new mobility vehicles	*Many new urban-friendly vehicle technologies are emerging, but these have no place to travel on NYC streets*	Redesign NYC bike lanes to be wider New Mobility Lanes, and build out the network	**Mayor (DOT)**
		Obtain Authority from the State Legislature allowing the 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)**
3.3 Propel New York City's design and construction industry into the digital age by moving to automated code review	*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*	Enact into law a specific date, perhaps 2032, by which all permit applicatons will need to be submitted in a new standard Building Information Modelling (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 NYC's codes from legal text into computable, machine-readable logic	**Mayor (DOB)**
		Launch an effort to train the entire architecture and engineering industry on BIM	**Mayor (DOB)**
3.4 Reduce sidewalk sheds by thoroughly testing how drones can evaluate the safety of building facades	*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*	Issue an RFP 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)**
		Incorporate the results of the aforementioned test into a revised approach to facade inspection starting in 2025	**Mayor (DOB), City Council**
3.5 Additional concepts under consideration	*New technologies will make NYC's buildings greener, but many buildings do not have the electrical capacity to accommodate new equipment*	Address the problem of electrifying buildings	**tbd**

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

Recommendations	Rationale	Initiatives	Responsibility
4.1 Make it easier for New Yorkers to obtain social services through the creation of a data locker and interagency verifications	*Applying for benefits is difficult, and requires significant documentation that is often already held by a different City agency*	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 provided benefits and when they need to reapply	**Mayor**
4.2 Make Community Boards more representative by keeping meetings virtual	*In-person Community Board meetings were often unrepresentative because meetings are difficult to attend in person; technology offers ways to broaden participation and accessibility.*	Advocate for Albany to amend the Open Meetings Law to allow continued virtual public meetings after the pandemic	**Mayor, City Council**
		Provide Community Boards with user-friendly, standardized webcasting kits	**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**
4.3 Additional concepts under consideration	*The Mayor's Management Report could be updated to make use of new forms of data*	Address the problem of accountability	**tbd**
	311 and nyc.gov could be updated and integrated	Address the problem of multi-channel interaction with the City	**tbd**
	An increased investment in digital outreach tools risks leaving behind those New Yorkers who cannot, or do not want to, use technology	Address the problem of ensuring those who do not use digital channels are not left behind	**tbd**
	Technology should broaden democratic participation	Address the problem of digitizing democracy	**tbd**

5. Futureproofing: Position NYC to shape the urban technology of the future

Recommendations	Rationale	Initiatives	Responsibility
5.1 Develop rules that shape and encourage emerging technologies in advance of their arrival	*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*	Commission one or more external entities to lead an accelerated process to develop regulatory guidance to address emerging technologies and their impact on the city	**Mayor**
		Create a permanent, independent Emerging Technology Advisory Panel to issue biennial reports to the City on emerging technologies and their implications	**City Council**